The Welding Engineer

Volume XXIII — January, 1938 — Number 1

The recognized excellence of Bastian-Blessing quality . . . the acknowledged reputation built upon nearly half a century of Engineering Leadership . . . a pioneer background of proven experience in regulator design . . . plus eighteen months of exhaustive FIELD performance, under FIELD conditions, by FIELD men. . . .

All these points have combined to produce an advanced precision two-stage regulator, which we are proud to introduce to all industry as . . . the RegOlator.

RegOlator embodies all the desirable features necessary to produce the ultimate in gas pressure regulation for welding, cutting, metal spraying, oxygen therapy, laboratory processes and all other precision control of high pressure gases.

You will be amazed at the infinite care which has been expended on every detail of the RegOlator to insure "straight line" performance. Complete specifications, description and illustrations are contained in the literature.

We invite you to investigate the precision two-stage RegOlator. Write NOW!

REGO TRADE MARK

REGOLATOR
FOR PRECISION
GAS REGULATION

The BASTIAN-BLESSING Company
278 East Ontario Street — CHICAGO, ILLINOIS

The REID-AVERY CO.

Announces the completion of an addition to the RACO plant, which provides 35,000 sq. ft. devoted exclusively to manufacture of the highest-grade WELDING ELECTRODES and WELDING WIRE

Included in the addition are new general offices, chemical and physical laboratories, raw material storage facilities, etc. Completely new electrode dryers have been installed, embodying the latest in scientific production control, guaranteeing absolute uniformity of product. The installation of additional extruding equipment has quadrupled our capacity for the manufacture of Shielded Arc Electrodes.

We manufacture *Bare, Lightly Coated Drawn Finish High-Speed Electrodes for both manual and automatic arc welding; Copper Coated Gas Welding Wire, and Extruded Shielded Arc Welding Electrodes.* Our Shielded Arc Electrodes (on all approved lists of governing bodies) are furnished for both straight and reversed polarity and for A. C. welding.

All manufacturing operations, from ore to finished product, controlled by our company

Operations in the Reid-Avery plant begin with hot rolled wire rods made to our own rigid specifications. The manufacture of the steel used in these rods is under our personal supervision and inspection. We are fully equipped to clean, bake and draw all wire from hot rolled rods, through Tungsten Carbide Dies in our own plant.

Production and development costs are distributed over a large tonnage.

Our plant is ideally situated in Dundalk, Baltimore, Maryland for rail and water shipments up and down the Atlantic Seaboard, throughout the South and Southwest and Pacific Coast points.

Attractive arrangement available to Welding Rod Manufacturers, Jobbers or Distributors

Practically all of our electrodes are marketed by our customers *under their own trade-marks and designations.* Welding Rod manufacturers, jobbers or distributors are invited to secure details of our proposition.

The REID-AVERY COMPANY, Inc.

Manufacturers of Welding Wire and Electrodes, exclusively, since 1918

General Offices and Mill: DUNDALK, BALTIMORE, MD.

VOL. 23

JANUARY, 1938

NO. 1

The Welding Engineer

MEMBER

Associated Business Papers
Audit Bureau of Circulation
American Welding Society
International Acetylene Association

G. H. MACKENZIE
President and Treasurer

RALPH S. KENRICK
Editor

M. S. HENDRICKS
Associate Editor

L. C. MONROE
Advertising Manager

Eastern Representative:
T. E. DEPEW, 1834 Broadway, New York, N. Y. Tel. Columbus 5-7843.

Pacific Coast Representative:
W. R. McINTYRE, 446 Western Pacific Bldg., Los Angeles, Calif. Tel. Prospect 0565.

Published on the 15th of each month by the Welding Engineer Publishing Company, 608 S. Dearborn Street, Chicago, Ill. Telephone Webster 7134

Advertising copy must be received not later than the 10th of each month.

IN THIS ISSUE

Editorial Page 17

Welding Progress in 1937 19

Stresses in Welded Joints 24

Gas Welded Rail Joints 27

Brazing of Copper Bus-Bars—II 32

Welding—The Major Tool of Industry 35

New Equipment Developments 37

News of the Industry 42

Research is Giving Industry Better Steels 20

Arc Welding Lowers Industry's Production Costs 21

They're Welding 'Em Bigger and Better 23

Get H. O. T. on Welding 26

Delaware & Hudson Employs Electrical Rail Welding 30

Motor Block Welding Saves Money for Customers 31

New Equipment Developments 37

News of the Industry 42

A. W. S. Activities 43

Foreign News 44

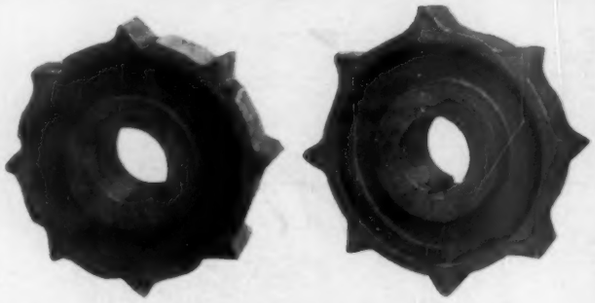
Trade News 46

Trade Literature 48

Classified Section 50

Subscription, payable in advance: United States and possessions, and Canada, $3 a year; Foreign Countries, $4 a year; Single copy, domestic, 25 cents; Single copy, foreign, 35 cents. Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

FOREIGN REPRESENTATIVES: AUSTRALIA and NEW ZEALAND—R. Hill, Matlock House, Davenport, Auckland, New Zealand; GREAT BRITAIN—A. D. Baynes, 6, Mordaunt House, Larkhall, Clapham, London, S. W. 8, England; SOUTH AFRICA—J. W. Arnison, 35a Victoria Avenue, Benoni, Transvaal, South Africa; JAPAN—Maruzen Company, Ltd., 6, Nihonbashi, Tori-Nichome, Tokyo, Japan; U. S. S. R.—Mesdunarodnaja Kniga, Kusneszki Most 18, Moscow, U. S. S. R.



WORN PARTS get a new lease on life!

with AMSCO NICKEL MANGANESE STEEL WELDING ROD . . . . .

Worn parts of rolled or cast carbon or manganese steel are successfully built up with AMSCO Nickel Manganese Steel Welding Rod in many cases salvaging costly equipment parts that would otherwise have to be discarded.

The sprocket wheels above show what can be done. The cost of building up the worn teeth with AMSCO Rod was but a small fraction of the cost of a new sprocket wheel and, in addition, it saved time, greatly reducing the "shut down" period.

AMSCO Nickel Manganese Steel Welding Rod is easily applied and gives a tough, ductile, work-hardening surface.

Plant maintenance men and job welders are invited to investigate the economies that can be effected with AMSCO Welding Rod in every industry.

It is made bare and coated in 1/8", 5/32", 3/16", 1/4" and 5/16" diameters; in lengths of 14" and 18"; also in coils and special lengths when required. Rolled and cast Filler bars and special shapes are also available.

Write for samples and information today

STEEL SALES CORPORATION

129 So. Jefferson Street — Chicago, Illinois

WAREHOUSES

Chicago, Ill., 129 So. Jefferson St., Phone Franklin 4280
Detroit, Mich., 4150 St. James St., Phone Oregon 2121
St. Louis, Mo., 4067 Park Ave., Phone Prospect 2655

DISTRICT OFFICES

Milwaukee — Minneapolis

INDEX TO ADVERTISERS

A

Aladdin Rod & Flux Mfg. Co. 58
American Agile Corp. 53
American Brass Co. 45
American Welding Society 14
Anti-Borax Compound Co. 56
Arcos Corp. 58

B

Barlum Hotel 56
Bastian-Blessing Co., The ..... First Cover
Black & Decker Mfg. Co. 10

C

Central Steel & Wire Co. ..... Third Cover
Chicago Hardware Foundry Co. 55
Chicago Steel & Wire Co. 55
Churchward Engineering Co., Inc. ..... Fourth Cover
Classified Ads 50
Commercial Acetylene Supply Co., Inc. 53

E

Eisler Engineering Co. 58

F

Faulk, F. R. 56
Fort Hayes Hotel 58

G

General Electric Co. 15

H

Handy & Harman 51
Harnischfeger Corp. 9
Hobart Brothers 9

I

Ideal Face Shield Co. 58

J

Jackson Electrode Holder Co. ..... Third Cover

L

Lincoln Electric Co., The 18

M

Metal & Thermit Corp. 16
Metal-Bond Mfg. Co. 56
Milburn Co., The Alexander 56

N

National Carbide Corp. 53
National Cylinder Gas Co. 12
New Process Flow Welding Co. 57

O

Okonite Co., The 49
Owen Electric Sales Co. 56

P

Page Steel & Wire Division 58
Pierce Governor Co. 57
Progressive Welder Co. 11

R

Reid-Avery Co., Inc. ..... Second Cover
Roberts & Co., Weldon 57
Roeblings Sons Co., J. A. 4
Ryerson & Sons, Inc., Jos. T. 48

S

Safety Gas Lighter Co. 46
Shawinigan Products Corp. 58
Speer Carbon Co. 7
Steel Sales Corp. 6
Steiner Oven Co. 58
Stoody Co. 55

T

Titan Metal Mfg. Co. 47
Torchweld Equipment Co. 57

V

Victor Equipment Co. 8

W

Westinghouse Electric & Mfg. Co. 13

E. Engin Lib
Mich Univ. Dept J.
Metal processing
9-24-1940

Railway Track Welding

THERE IS CONSIDERABLE INTEREST at the present time in welded railroad track. The New York Times, about two months ago, devoted several pages of its Sunday pictorial section to photographs of Delaware & Hudson "velvet track". Discussing the economic aspects of this comparatively new development in track construction with an engineer who has had many years experience in railway track maintenance, we obtained a fairly good picture of its possibilities. Railway men seem to be agreed that welded track is mighty fine, but invariably the reply is "We can't afford it." Apparently the expense per mile on single track ranges from $1,500 to $5,000 or more, depending upon the type of welding process employed and more particularly upon the system of supporting the rails. Some engineers hold the view that rail creep in welded sections must be guarded against stringently, necessitating a much heavier and more expensive type of tie plates and rail anchors.

From an engineering standpoint, the expansion and contraction problem has not turned out to be the formidable obstacle which at first thought it seemed it would be. Research engineers of the big steel companies have watched this development very closely and an experimental one-mile section of welded track in Pennsylvania is yielding considerable practical data, which should help men in designing and constructing future installations. Expansion seems to be limited to a fraction of an inch, owing to the method of rail fastenings employed. In other words, steel is such an elastic material that it is capable of handling the thermal stresses without serious danger of failure.

The material benefits of welded track are chiefly a saving of about $1.00 per joint, per year, in maintenance expense. A second very tangible benefit is the elimination of rail-end batter, which prolongs the life of the rail. Other benefits of "velvet track" are reduced wear and tear on rolling equipment and smoother operation of passenger trains. Both of these rather intangible benefits cannot be evaluated on a dollars and cents basis. Thus, considering only the saving in rail joint maintenance and elimination of rail-end batter, one maintenance engineer estimates that the cost of welded track can be completely returned in savings realized in five years' operation. This is surely a tempting return on the money invested.

★

Welding Cuts Production Costs

REVOLUTIONARY CHANGES in the design and fabrication of heavy pressure vessels and piping has enabled the petroleum industry to make substantial reductions in the cost of gasoline. It has been estimated by men who are close to the industry that the latest type cracking plants have doubled the output of commercial gasoline per barrel of crude oil. Translated into something the consumer can understand, this means that the present retail price of gasoline is about five cents lower than it would be, if industry had not doubled its production per barrel of crude.

It is generally agreed that these modern high-pressure cracking plants would not be a reality today were it not for welded fabrication. It is stated to be an engineering impossibility and economic fallacy to rivet heavy plate (above 2 in. thickness). The older methods of heavy pipe fabrication, employing bolted flanges, while not impossible from an engineering standpoint were certainly out of the picture from the standpoint of cost. A research engineer with a large fabricator, recently remarked that the job of securing the required amount of bolt tension in flanged connections on heavy piping (30,000 psi.) is a job for an elephant, not a steamfitter. It was necessary some time ago to conduct tests on bolted flanges of this type and it took several men about four days to build up the required tension in the flange bolts.

You can lower your welding costs 15% to 20% with the "Shield-Arc SAE"

The Baker Mfg. Co., Springfield, Ill., makes fillet welds in 1/4-in. high tensile steel at a rate of 40 ft. per hr. with their *"Shield-Arc* SAE." This beats the performance of their welders of conventional design by 5 ft. per hr.

On metals and alloys of all kinds and thicknesses, users everywhere report 15% to 20% faster welding with the *"Shield-Arc* SAE."

Equipped with Dual Continuous Control and self-protected against burnout, this *complete* welder is *sure* to lower your welding costs and improve your products. Ask for proof.

THE LINCOLN ELECTRIC COMPANY

Largest Manufacturers of Arc Welding Equipment in the World

Bul. 412 Bul. 401

THE LINCOLN ELECTRIC COMPANY
Dept. CC-454, Cleveland, Ohio

I'm interested in lower welding costs. ☐ Send free Bulletin 412. ☐ Send free Bulletin 401.

Name _____ Position _____

Company _____

Address _____

City _____ State _____

Portable flame cutting machine brings speed and economy of operation to fabricators.

Technical advances to speed production feature

Welding Progress in 1937

★ Review articles spot-light new developments in oxy-acetylene processes, arc welding, and steel production

New Applications Mark Oxy-Acetylene Progress

THE YEAR 1937 was marked by exceptional progress in the development of new applications for the oxy-acetylene process as well as in increased usage of existing applications. In steel fabrication and machinery manufacture, the oxy-acetylene cutting machine has taken a definite part in shop operations, and has had a decided influence upon shop methods, both as regards product design and manufacturing procedure. Through the development of the flame softening process, the field of application for oxy-acetylene cutting in production was extended to include a wide variety of air-hardening and quench-hardening steels, among which the low-alloy high-strength structural steels are of particular importance. In pipe welding, the amount of industrial piping installed by oxy-acetylene welding showed a notable increase over the previous year's record. Marked impetus was given to the use of flame hardening through the development of standardized apparatus and procedures. With 1937, a year of renovation, expansion of productive equipment, and scrapping of obsolete parts, the oxy-acetylene process established itself as an indispensable tool in such operations.

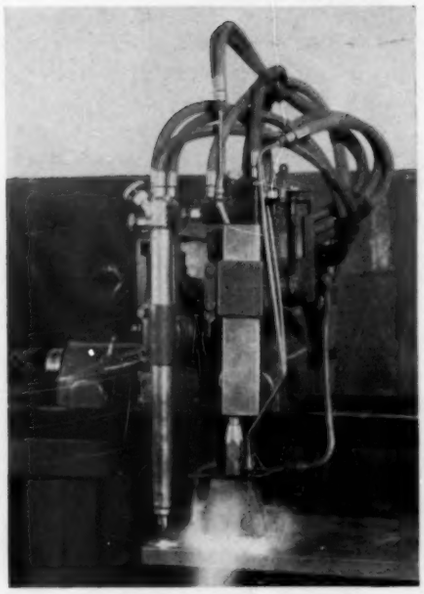
Oxy-Acetylene Machine Cutting

The year's activity in the general manufacturing industries has been marked by an increased use of welded construction, with an intensified activity in oxy-acetylene machine cutting operations. The wide field of operation of the cutting blowpipe enables it to adapt itself immediately to manufacturing requirements, whether cutting intricate shapes, many similar shapes at one time, or beveled edges. Furthermore, reduction of finished inventories and elimination of the risk of obsolete parts is possible, because the flexibility of the flame cutting machine has made "special order" manufacture practically as economical as "quantity" manufacture.

Stack cutting, or the cutting of piled plates, is another machine cutting development and one that has speeded production considerably. When it is desired to cut a large number of similar shapes from steel plate, several plates are piled one upon the other and the entire stack cut with a single movement of the blowpipe.

An important development of the year is the portable cutting machine which is light in weight and can be moved from one job to the next regardless of the location of that job in the shop. The machine will make straight line and circle cuts automatically. For cutting irregular shapes, the machine is guided easily by hand.

Methods have been developed for cutting stainless-clad and nickel-clad



Low-alloy structural steels are given wider use by the flame softening process.

steels. Clad materials are finding increasing use in the fabrication of processing equipment where the corrosion resistance of the clad layer is desired in conjunction with the economy of the low-carbon steel base.

Flame Softening

An important development directly allied with machine flame cutting is the flame-softening process for counter-acting the hardening effect of oxy-acetylene cutting on certain steels, such as the low-alloy high-strength structural steels. From a purely fabrication standpoint, the oxy-acetylene process provides a simple and economical production tool for shaping steel. From the structural standpoint, however, the flame cut edges of these steels must satisfactorily pass the standard tests prescribed for the parent metal. In most cases, this calls for liberal ductility and the retention of impact resistance and other properties within specified limits.

The flame softening procedure involves the use of multi-flame heating heads, either ahead of or following the cutting blowpipe. In this way the self-quenching action of the cold base metal is reduced, and the speed of the air quench is retarded, thus making it possible to cut these steels without impairing the physical properties of the cut surface.

The several methods of applying flame softening may be grouped under three treatments. Type No. 1 treatment is for plate thickness up to, and including, 1½ in., in which case a single multi-flame heating head, either directly before or after the cutting tip, is directed at the top of the cut edge. Type No. 2 treatment is for thicknesses from 1½ in. to 4 in. and is similar to the previous type with the exception that an additional multi-flame head is directed at the bottom of the cut edge. Type No. 3 treatment is for thicknesses above 4 in., and is applied to the face of the cut edge following the cutting operation, but before the steel has cooled to room temperature.

Among the more important applications of the flame softening process are: softening flame cut edges of gusset plates and web plates for the construction of buildings and bridges; preparing structural plates for railroad cars; finish cutting high strength steel products in steel warehouses; finish treating carbon steels of 0.40 per cent carbon or higher in steel mills.

Pipe Line Construction

In overland pipe line construction an interesting method of bending pipe has been developed. This is known as wrinkle bending. At the point of bend, the blowpipe flame is used to heat one or more narrow bands at right angles to the pipe length and extending about half way around the pipe. The pipe is bent a small amount as each band is heated, and the heated sections, which are on the inside of the bend, wrinkle up.

Flame Hardening

Flame hardening is a process whereby the surface to be hardened is brought to a red heat in a relatively short time by means of the oxy-acetylene flame, and then immediately quenched. A hard case is imparted to the steel surface without in any way altering the chemical composition of the steel.

Flame hardening is particularly suited to applications where a hard surface with a tough ductile core or body is desired. The hardening of wearing surfaces on steel parts that would be difficult, costly or impossible to heat-treat by other means is readily done by flame hardening. Typical successful applications of flame hardening include: gear teeth of all sizes, cams and camshafts, mill rolls, crane and sheave wheels, dies, valve stems, and similar parts.

Apparatus Development

New and improved apparatus has kept pace with the advance in applications of the oxy-acetylene process. New machine cutting blowpipes have been developed to give the users of oxy-acetylene machine cutting equipment more dependable operation than ever before available. New hand cutting blowpipes have been developed specifically for general service and can be used for practically any normal or heavy duty manual cutting operations on steel up to 12 in. in thickness.

Research Is Giving Industry Better Steels

A more complete understanding of what happens to steel in the various stages of its manufacture is being realized by the aid of scientific research intensively conducted by the steel producers. Notable is the research work, in the 174 laboratory departments of United States Steel Corp., into the fundamentals of steel making. This has made it possible to develop new products which are tougher, more ductile, and more corrosion-resistant. The following examples give a glimpse of the research achievements brought to practical culmination during 1937. Further development of these subjects, along with others under investigation will further enlarge the versatility of steel in meeting the demand of modern living.

As a result of the investigations, physical metallurgists know that the atomic structure of iron assumes two distinct forms controlling its propensity for dissolving carbon. Known as alpha and gamma iron, these two atomic arrays change from one to the other at a specific temperature as the iron is heated up or cooled down through the same temperature range.

By the proper control of conditions it is now possible to modify at will and, with more certain knowledge, the internal structure and hence the final properties of the metal within a con-

siderable range, correllating microscopic structure with properties. This knowledge is expected to lead to a steady advance in the usefulness of steel.

Investigation of "Creep"

"Creep" deformation, or the slow continued stretching which metallic parts undergo when subjected to tension under high temperature, has received special study throughout 1937 by metallurgists of United States Steel. Creep in steel products is motion so slow that it must be measured in millionths of an inch, per inch, per hour. Translated into longer distances, an object moving at this rate would take 13,704 years to move one foot, or 72,357,120 years to move a mile. In their studies of this subject, metallurgists have concluded that reliable data cannot be obtained, unless the speciments are subjected to creep.

Results of the tests to date indicate that special methods of heat treatment may make it possible to improve the natural resistance of certain steels to creep. The problem is of importance in the manufacture of equipment subject to stress at high temperatures. Steam pipe lines and oil-cracking stills made of steel, having an unduly high creep rate, may cause persistent operating difficulties or failures in service. Lack of knowledge of creep characteristics in certain steels now restricts pressures at high temperatures in such equipment, thereby placing an economic limit on the sizes to which oil-cracking stills may be constructed. Continued studies of "creep" are being prosecuted in the interest of solving the troublesome problems of those who use steel at relatively high temperatures.

Controlled Cooling

Various methods of heat treatment in the steel industry, growing out of research studies, have shown the characteristics of ductility, strength, toughness, and internal stress to vary according to grain size. A method of controlled cooling has been developed, in which rail steel initially is allowed to cool only to a few hundred degrees below its critical temperature. It is then reheated to above its critical temperature, before it is allowed to cool completely, the process refining the grain structure of the metal.

One practical application of this process is in the Brunorizing treatment for railroads rails. Such relaxation in a rail is conducive to longer life, because it delays fatigue which might ultimately result in a transverse fissure. In the "relaxed" rail, the internal stresses are minimized so that a vastly smaller proportion of the total rail strength is accounted for by the fruitless "pulling and pushing" within the rail and a high proportion of the strength is available to resist the fatigue of repeated loads under the wheels, which exert heavy blows at high train velocities.

Brunorizing, by controlling the grain size of the steel, has facilitated the "end-hardening" of rails. It practically eliminates the wearing down of rails at the ends, known as "batter," caused by the hammering action of the wheels leaving one rail and impacting the next.

Tests of Welded Rail

Mention of technical developments in connection with railroad steels recalls the interest welded rails have created during 1937. For two years a test mile of welded rails has been under observation near River Valley, Pa. Measurements made periodically show that although the maximum change of temperature was from 60 deg. to 110 deg. F., or a total of 50 deg. F., the maximum range of movement was only 5/32 of an inch.

Austempering, a method of heat treating which has been under investigation for a number of years, shows bright possibilities of imparting certain alloy steel properties to ordinary carbon steel. It is a process in which steel is cooled almost instantly from a point above its critical temperature to some lower level and held at substantially constant temperature, depending upon the final characteristics desired, in a bath of molten salt or lead for a predetermined time period. This differs radically from the well-known quench and temper method and develops extraordinary ductility even at relatively high hardness. The adoption of this new treatment for certain products makes possible lower costs and improved physical properties.

Research and development work in 174 laboratory departments throughout the steel Corp. come under the direct supervision of RUFUS E. ZIMMERMAN, vice president, in charge of metallurgy and research.

Arc Welding Lowers Industry's Production Costs

By H. S. CARD*

DURING THE FIRST six months of 1937 the volume of applications of the arc welding process showed every indication that it was on the way toward establishing a new high record. A deceleration was noted during the last quarter of the year, which is of course directly traceable to the decreased consumption of steel during that period. Therefore, while the total volume for 1937 will prove to be considerably greater than the 1936 volume, as measured by the consumption of welding electrodes, it will not very closely approach what it would have been if steel production had continued at the level of midsummer reports.

The real advances made by arc welding during the year are most strikingly shown by the fact that, during the first six months, the ratio of pounds of electrodes used to tons of steel ingots produced was 2.5 as com-

Advantages of redesign for arc welding has resulted in steadily increasing acceptance of this method.

*Development Director, Electric Welding Section, N.E.M.A., Pittsburgh, Pa.

pared to 2.4 in the previous year. A study of this index of the widening scope of the process has shown that during the past three or four years this figure has been steadily increasing at the rate of about one point annually. In other words, when industrial activity made it possible for steel production to get under way on a scale somewhat approaching full capacity, the arc welding industry began to double its rate of increase in volume of applications.

A brief review of trends in the heavy industries indicates that markets are being built up as a result of the acceptance of arc welding for important engineering structures. For the most part the adoption of arc welded construction has not been so much a matter of the savings involved in first cost, as it has been due to the broad economic advantages resulting from redesign. A consideration of what is going on in several industries will illustrate this point.

Alternating-current arc welding was used to fuse all of the steel framework of the new office structure at the Westinghouse Electric & Mfg. Company's transformer works in Sharon, Pa. A welder is at work on one of the building columns.

Cutting Gasoline Costs

The petroleum industry continues to be a large user of arc welding. By this time it has worked out satisfactory procedures for applying the process to the fabrication of equipment for every operating division of the industry. Prospects are good in the refinery division for continued demand for arc-welded pressure vessels, since the advances made in the refining art, due to development of welded vessels is rapidly making it more economical to scrap old equipment than to continue it in operation. A study of the economic value of the advances made in the cracking process, for example, has shown that the annual requirement of crude petroleum needed to produce the gasoline which 28,000,000 motor vehicles consume has been more than cut in half. Without these improvements automobile owners would have been obliged, in 1936, to share the expense of producing, transporting and refining an additional 1.1 billion barrels of crude petroleum. It has been estimated that all of this additional expense would have amounted to an increased price to the motorist of at least 5c per gallon. Arc welding in this industry, therefore, stands as an important aid to conversation of natural petroleum resources and an effective agent in reducing operating costs throughout the industry.

There has been noted in the industry, a trend to use a smaller number of thick-walled pressure vessels and a larger number of vessels made with thinner walls built of stainless-clad steel. Arc welding is a completely satisfactory method of fabrication when this material is used. The petroleum industry has not reached the end of its arc welding program. During the year some of the companies reported development of more satisfactory procedures for welding hot still tubes. There was also notable progress made in the welding of field joints in long strings of casing pipe. At the present time this application has been made practically standard by one or two companies and, if research on metals and methods continues on the 1937 scale, the result will certainly be a wide acceptance of this application throughout the industry. The total possibilties in the industry at its present rate of operation, would be the equivalent of about 20,000 miles of pipe line annually. Another encouraging report received during the year was that the percentage of pipe line constructed by arc welding had grown from 10% in 1928 to about 76% in 1936.

Railway Equipment

Developments in the railroad field last year were watched with unusual interest because attention was focused largely on the use of arc welding in new car construction. One car shop is now equipped and organized for manufacturing all welded freight cars in lots of 1,000 or more. In these new car building activities, arc welding plays an important part in reducing the weight of rolling stock, sharing the honors with high-tensile, low-alloy and stainless steels and with the electric spot welding process. Costs are comparable to previous methods of fabrication and weight savings of the order of 5 tons per car represent to the railroads an operating saving of nearly $100 per car per year. Weight savings on passenger cars have been estimated in the neighborhood of 30 to 35%. 1937 also witnessed the putting into operation of the first locomotive with an all-welded boiler.

Welded Oil Tankers

Although there has been a steady advance in the application of arc welding in shipbuilding, last year appears to be an important one, because these advantages were dramatically brought to public attention by the launching of a welded 18,500-ton tanker. About 300 marine engineers and naval architects had an opportunity to inspect this huge vessel during its construction and to discuss all phases of it in a meeting held on the same day. Prominent authorities in the shipbuilding field at this time commented favorably on the definite trend toward the use of arc welding throughout in future ship construction. Of no less importance is the widespread use of the process for building cargo vessels to operate on inland water-ways. In this connection there was reported the completion of an all-welded plant in the

Pittsburgh district for the construction of all welded steel barges on a large scale production basis.

A report that diesel engines accounted for more than 60% of the horsepower of marine engines, either under construction or being installed at the end of last September, coupled with the reports of the growing number of railroad locomotives being built to use diesel engine power, points to the growing acceptance of diesel engines for transportation service. In this development electric arc welding has rendered great service by making it possible to fabricate engine frames, crankcases, etc., from rolled steel. The immediate advantage in this field is that of being able to attain maximum efficiency in power output, without increasing the size and weight of the power plant to a degree that would make it impracticable for transportation service. Ultimately the public gains a better service at a lower cost as a result of the fuel economy and all-around efficiency of these modern power plants. Welded structures have proved so advantageous and so completely dependable in this field that it can be taken for granted that we have here a growing market for welding machines and electrodes.

Bonneville Dam

An outstanding event in the field of power was the fabrication during 1937 of important parts of the Kaplan turbines for the Bonneville Dam project. Twenty tons of shielded arc electrodes were used in this construction, a large building formerly used as a foundry having been completely re-equipped to turn out these huge structures by welding. In the steam power field it was noted that, arc-welded boiler drum pressures up to 1500 lbs. per sq. in. were becoming quite common, one installation for 2500 lbs. pressure being reported. There was also a lot of progress made in techniques for electric arc welding on high-pressure piping required in these installations.

Those interested in structural welding were encouraged by the official approval given to the use of welding in building construction in the new building codes of New York City and Chicago. The subject has been active in both cities for several years and it was gratifying to the industry to learn that both cities took the same action almost at the same time.

Altogether it appears that as a result of the developments of the past twelve months, there remains practically no type of engineering or industrial structures where arc welded construction has not demonstrated its dependability and its economy. More important than fabricating economies are the long range benefits to industry and to the public which come as a result of applying new ideas in design in which the use of the welding arc is an essential feature. It is on the basis of extending the applications into these important constructions to the point of maximum use that the arc welding industry finds its greatest opportunity for further expansion.

They're Welding 'Em Bigger and Better

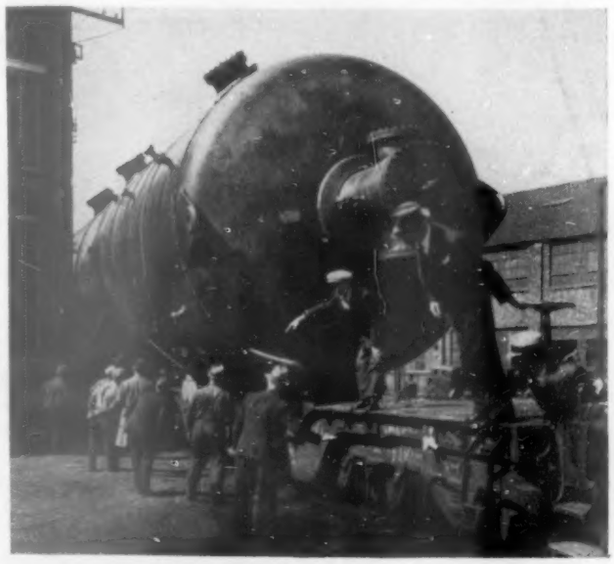
What is claimed to be the largest and heaviest single piece of freight ever shipped recently left the Jersey City, N. J. plant of The M. W. Kellogg Co. enroute to Whiting, Ind., via the Hudson River, the N. Y. State barge canal and Lakes Ontario, Erie, Huron and Michigan. This record shattering structure was an evaporator tower 80 ft. long, 15 ft. in diameter, and weighing 460,000 lbs.

None of the usual methods of transportation could be used. The size of the tower prohibited its shipment by rail as no railway is constructed with sufficient clearances between tracks to permit the passage of any such enormous structure without suspending the operation of all trains on adjoining tracks. This would, of course, be prohibitive from the standpoint of practical railroad operation as well as from the standpoint of expense to the shipper. No steamer or barge operating through the N. Y. State barge canal could possibly pass under some of the fixed bridges spanning the canal if the tower were placed on deck and its size and weight made it impossible to stow it in the hold.

A careful engineering check of the exact weight, dimensions, buoyancy and other characteristics of the tower itself, and of the water route indicated the practicability of ballasting and partially submerging the tower in water, and then towing it all the way from Jersey City to Whiting.

When launched into New York Bay the tower was floated, with the manholes down, and carefully ballasted to prevent rolling over during the passage through the Great Lakes. Air at 25 lb. pressure was pumped into it, and all manholes and other projections were carefully protected with heavy timber covers and the entire tower encased in 14 in. square timbers to insure its safety from bumping. The voyage was made with the tower approximately two-thirds submerged.

The dimensions of the tower give some idea of the ingenuity displayed by those who planned its transportation. Fabricated from steel plates each 50 ft. long, 10 ft. wide and 2 5/16 in. thick, the longest plates of this type ever made, the tower is 80 ft. long, 15 ft. in diameter, has a cubic content of 12,500 cu. ft. and weighs 460,000 lb. It is 25 ft. longer than the longest flat car in the country and its diameter is approximatelly that of the subway tubes under the Hudson River in New York. Over 600 lineal ft. of welded seams hold the steel plates together and every inch of welding was X-rayed to insure the safety and durability of the welds.



Huge 460,000-lb. evaporator tower starts on its first lap of the 1,371-mile journey to Whiting, Ind.

A simple explanation of shrinkage

Stresses in Welded Joints

★ Origin of residual stresses in steel and a method of demonstrating their magnitude are clearly outlined

By BELA RONAY

Senior Welding Engineer, U. S. Naval Academy, Annapolis, Md.

THE PRACTICAL USER is capable of identifying three states in the existence of ferrous metals, i. e., liquid, plastic and elastic. The properties of ferrous metals in any of these states are fairly well understood and this knowledge may be used to analyze the conditions which obtain in the course of fabrication by welding.

These fundamentals are simple and may be used by any one who takes the trouble of applying them to practical problems. This does not imply that by using the basic formula which applies to the shrinkage of molten steel and that of the co-efficient of expansion of the solid material, the numerical or quantitative value of the stresses which develop in a welded assembly may be readily predicted in all instances.

It is known that mild steel in changing its state from liquid to solid shrinks at the rate of ¼ in. per ft. If it is fully restrained from shrinking it cracks and the width of the crack or the total width of the several cracks which may develop at the zone of restraint is proportional to the above given figure.

It was said above that steel shrinks ¼ in. per foot when changing from liquid to solid. If the restraint prevents the development of a major fraction of the shrinkage rate, a crack develops and the strain is relieved. Supposing, that the value of the restraint is only a minor fraction of the ¼ in., i. e., not exceeding 0.015 in. per foot. What can be expected to happen in this particular case. Under the above specified conditions, the metal is free to shrink until the specified restraint value is reached. By that time the temperature of it is lower and its state changes from liquid to plastic. In the latter state the metal is capable of stretching under relatively low stresses, a condition referred to as having a low yield point.

Therefore, under the above given conditions a further adjustment takes place until the metal cools below that temperature limit where it assumes its third and last state, i. e., it becomes elastic. This occurs after the cooling metal loses all color and its temperature is below 900 deg. F. Within the elastic range the stress and strain are directly proportional. This property of metal is expressed mathematically by Hook's Law: s=eE, where "s" means stress, "e"=strain and "E" is the modulus of elasticity, which in the case of mild steel is usually taken at 30,000,000. Consequently, if the elastic limit of the material is 30,000 p.s.i., then the maximum elastic strain e (Max.)=30,000/30,000,000; or 0.001 in. per inch of metal.

This means that if in cooling from the plastic range a restrain of 0.0007 in. is encountered, then the final residual stress at room temperature will be 0.0007×30,000,000=21,000 p.s.i.

Suppose the casting containing this stressed member is loaded by a force causing a stress of 15,000 p.s.i. in the above member and that the direction of the force is the same as that of the residual stress or, expressed mathematically, of the same sign. Then the resultant of the two stresses will be the sum of the two or 21,000+15,000=36,000 p.s.i.

Stressed Beyond Yield Point

This value is in excess of the yield point of the metal; therefore, it will stretch until the stress is practically relieved. Suppose the load is then removed and after an appreciable interval it is applied again. The residual stress is now only a minor fraction of its original value; therefore, on re-applying the above load the combined or resultant stress will be lower than at the first application. When the above described conditions exist the presence of residual stresses of a magnitude approaching or even exceeding the yield point do not appear to be of serious importance because they may automatically relieve themselves.

However, the above conditions do not exist in all structures and may exist primarily under static loads only. Moreover, the plastic yield of a mem-

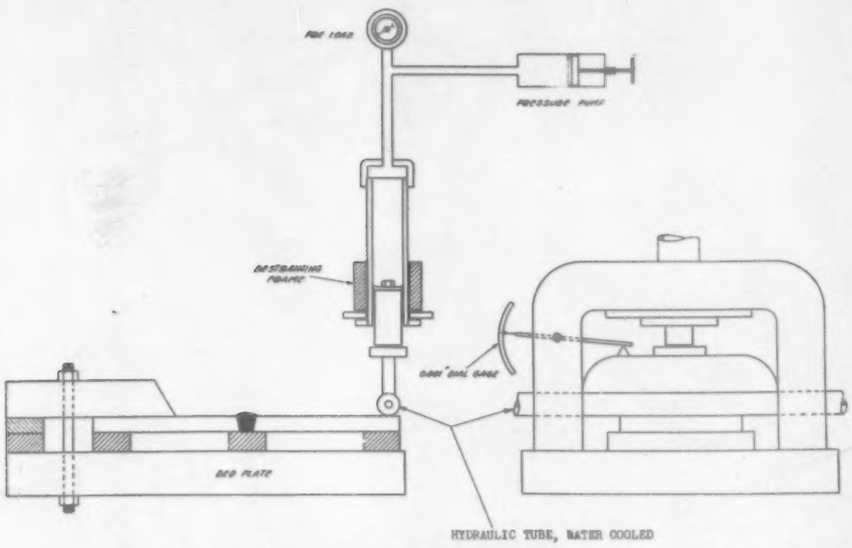


FIG. 1—Equipment for demonstrating the shrinkage stress developing in a butt joint made under restraint.

ber of a structure, even under static conditions may upset the equilibrium thereof, so that the load which ordinarily meant to be transferred by the non-yielding companion members may be concentrated on the yielding member causing it to fail by actual overloading. However, in a large number of structures, many built to carry dynamic loads, the presence of the residual stress, while not entirely negligible, is not necessarily of such character that it may impair their safety.

Two Kinds of Residual Stresses

Residual stresses in welds are two kinds. One is the result of the restraint against shrinkage and is a straight tension force, though it may be shear also. The other is the result of restraint against the action of a force couple, hence it is a bending moment.

Let us follow the development of the stress conditions in course of completing a two-pass butt weld joining two flat plates which are assembled over a chill bar and are tacked thereto at both ends of the joint. The plates are supposed to be free of any other restraint except that caused by their own weight.

Let the first pass be deposited as a fairly heavy layer of weld metal. This means that a small volume of the base metal is re-melted in course of deposition and that an indefinite volume of the latter beyond the re-melted stratum is heated to a fairly high temperature. It is fair to assume that the deposit in solidifying gives off some of its latent heat to the base metal and so, while the weld metal shrinks, the base metal actually expands. Under such conditions it may be further assumed that the stress, on completion of the pass and just prior to the super-position of the second pass, is not great, because as the weld metal reaches the elastic state, the sign of its movement is opposite to that of the base metal. If the masses involved are about equal the two stresses being of opposite sign may altogether cancel one another.

Most cores set in molds act as restrainers on the free shrinkage of the metal which surrounds them. Yet, it is known that innumerable core castings are made which do not contain shrinkage cracks, nor do they fail in service prematurely.

Are these castings free of shrinkage stresses? The answer to this question is that most likely they are not free of stresses, but the exact value of the so-called residual stresses are not known. Here, a new term, "residual stress," was introduced. What is it? To understand the development of the residual stress it is necessary once more to refer to castings.

What Causes Warping

With this condition obtaining the second pass is superposed. Before the stresses developing in this fresh layer are analyzed, let it be remembered that the first layer is fairly heavy so that the second layer, which is of normal thickness cannot remelt it entirely. Consequently, as the second layer contracts the re-heated weld metal beneath it expands as does the adjacent base metal, resulting in what is known as the warping of the assembly.

On completion of the second or final pass there is no further heat input and eventually a stage is reached when the weld metal of the first layer and the base metal of the weld zone cool off to the temperature of the main mass, while the temperature of the weld metal of the second pass is still lagging by 50 deg. F. It may be assumed then that the final or residual stress, which may be computed, is the contraction caused by the 50 deg. F. temperature gradient between the weld metal of the second pass and the body of the assembly.

If the average width of the weld metal of the second pass is 0.5 in., then the value of the strain is $50 \times 0.0000077 \times 0.5$, where the middle factor is the coefficient of expansion of mild steel at low temperatures. The product of the above is 0.000193 in. and the corresponding stress from Hook's Law (as given above): $0.000193 \times 30{,}000{,}000 = 5790$ p. s. i. which is a stress of not particularly serious importance.

Lower Inter-Pass Temperature

Let the above described joint be duplicated, but this time changing the welding procedure somewhat. Let the deposit forming the first pass or layer be of the same thickness as on the previous occasion, but permit it to cool to room temperature before the second and final pass is made. On this occasion, the temperature gradient being greater between the first pass and the present cooling second pass, the maximum temperature of the weld metal of the first pass, which develops as the result of the heat input of the second pass is lower than on the previous occasion. Thence, the total expansion of the weld metal of the first pass is less, also causing a greater stress to develop in the weld stress of the second pass than noted on the previous occasion and as manifested by the greater degree of warpage. Eventually the temperature of the first pass and of the base metal adjacent the weld will descend to that of the main mass while the temperature of the last pass may lag 100 to 150 deg. F.

Under the above conditions the final strain will be $150 \times .000007 \times .5 = 0.0005775$ in. and the corresponding stress: $0.000577 \times 30{,}000{,}000 = 17{,}325$ p.s.i. This stress added to a design stress of 15,000 p.s.i. steps up the combined value to that which borders on the yield point and might exceed the proportional limit which is

somewhat below the yield point. This condition as pointed out already may be dangerous and must be avoided.

The above described occurrences may appear to the practical man as purely speculative unless they are readily demonstrable.

The set-up shown schematically in Fig. 1 may be used to demonstrate the value of the bending moment which develops when free shrinkage, and its sequence free warping, are restrained. The simple apparatus offered here enables the observation of several phenomena and sequence of their development which are either direct or may be arrived at by deduction.

Visual Demonstration

The plate under the hydraulic restrainer may be regarded as a cantilever beam which tends to deflect (rise) on completion of each pass. This deflection is shown by the 1/1000 in. indicator which is mounted, either on the retaining frame, or on the solid welding bench. The hydraulic press is used to return the plate into its original plane—in course of the test this is executed by reducing the deflection indicated on the dial to zero. This procedure is repeated on completion of each pass. Observe the difference in the deflection values and corresponding gage pressure from pass to pass (using assemblies of identical material and dimensions) under *various interpass temperature conditions.*

Computing the Stress

On completion of the joint let the assembly cool to room temperature. Record the final deflection indicated by the dial when the load is released. Repeatedly release the load and read the maximum deflection and read the load again until 0 deflection is reached when the maximum gage pressure shall be recorded. Use for computation the mean of the recorded values. This procedure reduces instrumental error. In getting ready to compute do not forget that the actual load is the product of the maximum gage pressure recorded, multiplied by the cross-sectional area of the plunger of the hydraulic press.

From the data available one may compute the value of the stress which causes the deflection or warpage and from the measured value of the latter by means of a check calculation, the efficiency of the apparatus may be obtained.

(Note—Belay Ronay's formulas for computing stress will be published next month.)

Get H.O.T. On Welding

By H. O. T. RIDLON

My Move

Came to Chicago for the holidays—the good wife came the first of November—and doggone me if the boss didn't collar me and stick me behind a desk for the next three months helping him on some special stuff. So here I am, so if any of you guys want to write me—and I always do enjoy hearing from you—I'm living at 6321 Winthrop Avenue, Chicago, Illinois, until April first. You know I've always maintained that after fish and relatives have been in the house for three days, they stink.

Mastery

There is an ease, a sureness, a lightness of touch, that comes from mastery. And so it is with things that we know. Most of us feel—or we should, at least—that we don't know all we should. Once in a while most of us sort of take stock of our own abilities and knowledge and find that we haven't got as much on the ball as we'd like to have. Or else something comes along and gives us a good swift kick in the conceit. It seems that the old bean we carry around on our shoulders is only able to hold so much and the thing for us to learn more than anything else is where we can get knowledge when we want it. Things in this world of ours move, so that we cannot hope for much more than to become masters at our trade and then know where to get more "info" when we need it.

Well, my fine feathered friend, then the thing for you to do is to realize that the chances are better than 100 to 1 that you'll never learn all there is to know about this welding business we're in, and if any of you lugs think you will and want to bet you've got the odds—get your order in NOW for that new Ninth Edition of the WELDING ENCYCLOPEDIA that will be off the press in a month or two now. 'Cause, fella, that's the book that is going to tell you the things about welding that you don't know.

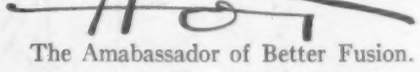
Fit It or Have a Fit

And Boy how true that is when it comes to pipe welding. At the Purdue Welding Conference in December there was a lad that has laid out a complete set of blue-print templets for every type and size of pipe joint. And I guess the complete set comes mighty cheap when you figure everything and how much good they can do you if you weld any pipe at all. If you have a set of these blue-prints, you can make paper templets by tracing, or permanent ones out of very light sheet metal. And are they ever handy, out on the job when you've got a lot of cutting and fitting to do. Of course, there's a few other things necessary to make a good fit-up job on pipe, beside a set of good templets, and they are to know how to cut, have a steady hand, a real good cutting torch, and regulators that will deliver a constant volume and pressure. If you've got all those things combined, Mister, you've really got something.

The Mail

Yes, it was mighty heavy this month, and it may take me sometime to get around to answering all your letters, but you'll hear from me some one of these bright mornings. But there is one thing that I was impressed with and that is the number of youse guys that wanted info. on welding die castings, so I feel that there must be a lot of you lugs that are just too constipated when it comes to writing that won't take the time and trouble to write me. Don't tell me that during "this panic" you haven't time to write.

As always,



The Amabassador of Better Fusion.

(P. S.) Say, you guys, don't lay off buying the kind of equipment I sell just because I'm not out in my territory, for a few months. I have a young pal out there, Jack Owen, pinch hitting for me in the territory. He's a nice youngster, so be good to him, as you always have been to me. Thanks!

Two welding operators weld simultaneously on either side of the rail, joining 112-lb. rails into long continuous lengths.

Experience of one railroad with

Gas-Welded Rail Joints

★ Service life more than doubled in two short tunnel sections by use of welded rail — How rail ends are prepared and field welding procedure clearly described

By R. R. CUMMINS*

Assistant General Manager, Central of Georgia Railway, Savannah, Ga.

WELDING IN CONNECTION with track maintenance is playing a most important part in prolonging the life of rail, frogs, crossings, switch points and numerous other items which go into track structure, and the practice is rapidly expanding. Prior to 15 or 20 years ago, maintenance of frogs and crossings consisted of tightening and replacing bolts and when worn beyond allowable limits they were taken out and scrapped.

The railroad with which I am connected, realizing the advantages to be gained, was one of the pioneers, if not actually the first railroad, to adopt welding in place with portable welding outfit, as a means of building up battered rail ends, butt welding rails in street crossings and station landings, repairing frogs, switches, etc. From a beginning of one welding unit in 1917, we now employ eleven skilled operators and their helpers.

There has been marked improvement in the methods now employed compared with what was done in the beginning, notably increased metallurgical knowledge, improvement in the quality of welding rods and torches, better adapted to the work, as well as the experience gained by welding operators. After all there is no substitute for the skill of the craftsman in making it possible to continue in first-class condition, and at reasonable cost, many parts of the track structure which were formerly scrapped.

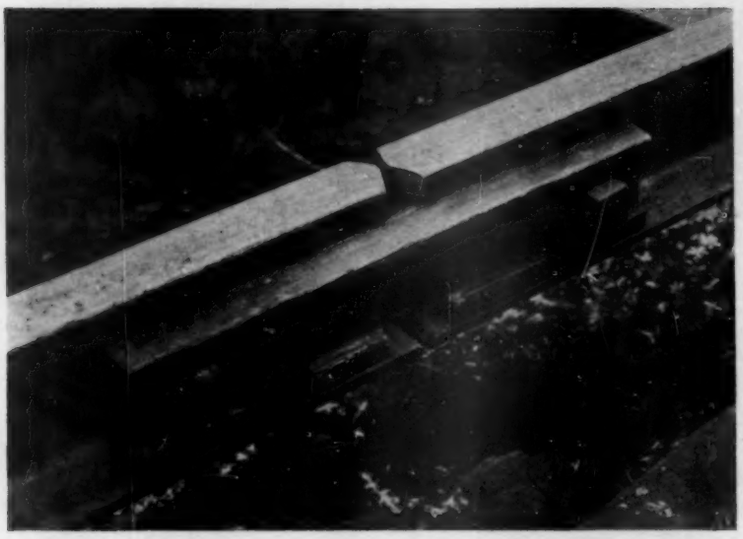
Butt welding of rail ends is of more recent development. Confronted with the problem of economically maintaining good riding track in two tunnels on our Birmingham District, it was decided to experiment with welded joints. The tunnels in which the welding was done extend through Coosa Mountain and Oak Mountain, located about 21 miles east of Birmingham. Both tunnels are single-track, the former being 2,431 ft. long and the latter 1,198 ft.

Because of limited overhead and side clearances and rock floors, it is practicable to apply only a limited depth of ballast under the ties, and this, coupled with the constant dampness from roof drip, and severe corrosive action of gases on bolts and angle bars, resulted in low joints and severe rail batter, regardless of the efforts of track forces. As a consequence, the service life of the rail and fastenings was limited to about 3 years and riding conditions were never comparable with track in the open.

Initial Installation

To improve these conditions, new 90-lb. ARA rail was laid in these two tunnels during August, 1930, butt-welded on the outside in lengths of 429 ft. and pulled into the tunnels by a locomotive, where the sections were joined by welds into continuous rails. As a special precaution, all of the welded joints were fitted with second-hand 100%, four-hole 90-lb. joint bars,

*Presented at the 38th annual convention, International Acetylene Association, Birmingham, Ala., November 10th, 11th, and 12th, 1937.



Rail ends prepared for welding with joint-bar clamps to hold rail in line during the operation.

and the joints fully bolted, making it possible to derive the value of the continuously welded rails without concern for the safety of the track structure.

Tests showed the range of temperature within the tunnels as 73 deg. F. so that no trouble was anticipated with the expansion and contraction of the long rails; ¼ in. expansion space was allowed at the first joint at each end of the welded sections, but this proved unnecessary since there has been no perceptible movement of the rails.

Preparing Rail Ends

The only work on the rails prior to butt-welding was that which is called "V"ing the rail ends. This was accomplished with a cutting torch, the web and flanges of the rail base were beveled to form a distinct "V" at the junction of the webs and base flanges of abutting rails. The rail head, on the other hand, was beveled downward from a point about ¼ in. back from the end of the rail, except for a rib left in the center of the head to facilitate starting the head weld.

Welding was commenced at the center of the base, at the base of the web, with the rails tight together so that the temperature of both could be kept as nearly uniform as possible during the welding operations. From the center of the base, the welds were extended outward on each side, completing the base weld, then carried up the web and half-way through the head. Using a different rod, the balance of the head weld was then made, the top surface being completed last.

In this latter work, at the running surface of the rail the new weld metal was constantly peened as applied, using a 2½-lb. machinist's hammer. The final smoothing and finishing of the top was accomplished by holding a 3-lb. flatter on the welded surface and striking it with an 8-lb. hammer. After completing a weld, all excess metal on the fishing surfaces of the head, and on the web and base, was removed with a torch to permit a snug fit of the angle bars. All welding was done by two crews, each consisting of an experienced operator and an assistant. Each crew completed an average of 3.29 welds per 8-hr. day. The average amount of material used in making each weld was 2¼ lbs. of steel, 80 cu. ft. of oxygen, and 70 cu. ft. of acetylene.

The long welded sections were allowed 24 hours to assume the normal temperature within the tunnels before being laid in track. Prior to rail replacement, the track was carefully overhauled, necessary tie renewals made and all irregularities in line and surface corrected. However, no ditching or ballasting was done. As an extra precaution, to retard corrosion of the new rail and fastenings, all of the exposed steel of the track structure, except the running surface of the rail head, was painted with a preservative coating, and this practice has been continued each year.

Service Life Doubled

During March, 1937, after 6½ years of service, which was more than double the service obtained before welded rail construction was adopted, it again became necessary to renew the rail, this being due to loss in section from corrosion which in some instances approximated 30%. Proceeding on the assumption that longer life would be obtained with heavier rail, it was decided to use rail of 112-lb. section, welded in continuous stretches.

Consideration was given to welding by other processes, but as satisfactory results had been obtained by the oxy-acetylene method for butt-welding rail ends in 1930, it was felt that with added experience, improved methods, better welding torches and material, together with the use of grinding and surfacing machines not available during the first experiment, continuance of the oxy-acetylene method was justified.

In carrying out this work, it was decided to clean out the ditches thoroughly, renew all ballast, and replace the cross-ties out of face. Straps, consisting of old, light angle bars, were applied to the 112-lb. rail which would not contact its head or base, this being in the nature of an added precaution in the event of a broken weld.

Ditching and removal of the ballast was commenced March 15, 1937. The force employed consisted of an extra gang of one foreman, assistant foreman and 26 laborers. Material to be removed was loaded on push cars equipped with standard ditching dumps. A motor car was used for hauling to the dumping ground.

The 624-ft. welded lengths were pulled into the tunnel and joined by butt welds under the light of an acetylene floodlight.

The butt-welding of the rails, which was done at a convenient location on tangent track outside the tunnel, was commenced March 22, 1937. The rails, 39 ft. in length, were placed on cross ties and lined up in four stretches of 16 rails each, the ends opposite each other, so that four joints could be welded without moving the welding apparatus. Three sets of welders were used and, in addition, three instructors were continually present, for the double purpose of instruction and assisting in the welding. The ends of the rails were "V" 'd with a cutting torch prior to welding by beveling the ball and web into a double "V" and the base into a single "V" in order that an equal amount of metal might be placed by the two torches while working simultaneously on each side of the rail. The ends of two rails were then placed together in a straight line and a pair of angle bars, having a portion of the web cut out to allow welding space, were applied. This maintained perfect alignment at the rail ends during the welding process.

Base Plate Used

A 3/16 in. steel plate, 2 in. by 5½ in. was placed under the base of the joints for the purpose of preventing flow of the metal as well as giving added strength. The weld was then started on the plate across the base. After the base of the rail was welded the angle bars were removed and carried ahead for other welds. Two torches were used to work the metal into place, one on each side of the joint. Steel welding rods 3/16 in. and ¼ in. in diameter were used. After the base and web had been welded, a 1 in. x 2½ in. x 3/16 in. steel plate was placed under the ball of the rail on each side and the head was built up on these plates, which prevented flow of the metal.

Rail joints were reheated with the blowpipe and normalized by cooling slowly in an insulating box.

A convenient jig aided in making the weld in the ball of the rail.

After completing the weld, the rail was heated by using two large tips, for a distance of 6 in. on each side of the weld and a metal trough 8 in. by 3 ft. was placed around the joint and packed with ground asbestos to normalize the entire weld, which was allowed to cool slowly for about 30 min.

Welding in the Tunnel

Half of the welded section necessary to extend through the tunnel was dragged in by a locomotive, necessitating the last butt-weld in the tunnel. The welded rail sections were laid on the old cross ties replacing the released rail, and when this was completed, renewal of the ties out of face was commenced. Due to train schedules, one gang did all of the track work at night, and in the interest of time a second gang was employed during the day to clean up and carry in material for the night gang.

Creosoted pine cross-ties, 7 in. x 9 in. x 8 ft. were used, carefully selected, pre-bored and adzed. Tie plates, 7½ in. x 11 in., which had been previously given a thorough coating of a rust retardant, were applied.

The temperature, which was read twice daily during the progress of the work, ranged on the outside of the tunnel from 32 to 80 deg. F., and on the inside from 34 to 66 deg. F.

Until this year we had never attempted butt welding on high-speed track in the open, but recently we have experimented with a stretch on our line between Macon and Atlanta, the installation being of too recent date to arrive at conclusions. This section of welded track is of 112-lb. rail, 2,184 ft. in length, 20% of tangent track and 80% on a two-degree curve. This work was carried out in the same manner as has previously been described in the tunnels, with the exception that 8 in. x 12 in. double shoulder tie plates were used, fastened independently to the cross ties with cut spikes. No rail anchors were used in this welded stretch and permanent reference points have been established at various locations as a means of determining any movement that may occur.

A pleasant day's work for L. O. Schneiderwind, president of Omaha Welding Co., Omaha, Neb. His brother (right) helped him.

Delaware & Hudson Employs Electric Rail Welding

In 1933, the Delaware & Hudson Railroad started the laying of long welded rails, utilizing the thermit process. In 1937, 30 additional miles of continuous welded track were laid by the combination of electric flash butt welding and thermit welding. In this process 20 or more rail lengths were joined by electric welding, and then these welded sections were joined together by the thermit process, thus making continuous rail sections between insulated joints. The insulated joints are necessary, because of the automatic track circuit signaling. The D. & H. rails before welding are 39-ft. long and of 131-lb. section. This means that the rail weighs 131 lbs. per yard. Rails are fastened to the tie plates by spring clips, and the plates are screwed to the ties by lag screws.

Welding Power Supply

Electric power for the welding operation is supplied by two steam turbine-driven generators, housed in a specially constructed steel box car. One of the generators supplies power to the welding machine and also to a haulage winch used for moving the long sections of welded rail, while the other supplies power for lighting, for the operation of the hydraulic pump of the rail changing mechanism and for all auxiliary motor-driven units forming a part of the welding outfit. Steam for the turbines is supplied by a road-type locomotive and the steam demand of the turbines ranges from 15,000 to 22,000 lb. per hr., with pressure at the turbine nozzles between 175 and 200 lb. per sq. in.

In addition to the locomotive and power car, the equipment required consists of a rail-rack car for lining up and otherwise preparing rails for welding, the welding car, a series of five flat cars on which are mounted an oil furnace for stress-relieving and a number of joint grinders and the required number of flat or open-end gondola cars for hauling and transporting the long welded rails to the point where they are to be installed. The rail supports consist of T beams with rollers in the center on the grinding cars and short lengths of scrap rail (three to a car) on the storage cars. The electric haulage winch is located at the end of the string of storage cars. The grinders are driven by gasoline engines.

The welding car is a box car which houses the flash welding machine, a hydraulic pump, electrical control equipment and roller conveyors for moving the rails to and from the point of welding. The welding machine is a two-part unit on a structural steel bed, one part of which is rigidly fixed, while the other is a movable platten supporting the end of the rail which is to be welded to the long string of rails. Both the fixed and movable sections of the machine are equipped with hydraulic clamps for holding the rails to be joined, and with electric contact clamps which pass the welding current into the rails. A transformer reduces the turbine output to the low voltage and high current values necessary for welding.

Rails to be welded are loaded on to the rack car by a crane. This car is a flat car equipped with an inclined rail rack, capable of holding nine rails. The rack feeds on to a line of rollers through the center of the car, over which the rails are moved forward one at a time into the welding car. Preparation of the rail ends for welding consists of a small amount of grinding on the head and base at each end, to remove any rust present and to insure good electrical contact in the welding machine.

Single Operator Control

The welding operation is controlled by a single operator. When the rails are brought to the welding position, they are gripped by clamping dies and by the current contact pads in the two parts of the machine. The operation consists of three steps, namely, preheating, flashing and upsetting. In the preheating operation, the single rail fixed to the movable platten is brought up to intermittent contact with the end of the fixed rail, which in a short time raises the temperature of the rail ends to practically a fusing heat. This is followed by the flashing operation, consisting of continuous short-circuiting of the welding current, effected by bringing the rail ends into continuous contact. In this operation the steel at the rail ends changes to a molten stage and flashes out from the contact faces, removing rough spots and oxidized metal on the rail ends. After a pre-determined amount of flashing, the rail ends are brought together under hydraulic pressure, causing the molten metal at the ends to

One operator controls the electric welding operation, which comprises three steps—preheating, flashing and upsetting.

Stress-relieving is accomplished in the same period of time required to make the weld at the next joint. Furnace is oil fired.

fuse together and produce an upset area around the joint. The clamps are then removed immediately, and the platten is moved forward sufficiently to shear off the upset metal on the underside of the rail base.

Stress Relieving

While one joint is being welded the one previously made is heated in an oil-fired furnace on the first flat car adjoining the welding car. The weld is brought to a pre-determined temperature and then allowed to cool under atmospheric conditions. The required stress-relieving temperature was arrived at after a series of tests, and is controlled by a recording pyrometer.

The several grinding operations are also carried on on subsequent flat cars while the welds are being made. The first operation consists of grinding away the upset metal from the two side faces of the rail head. The second operation takes the metal from the underside of the rail head on both sides, through the fillet area and from the top of the base flanges, and a certain amount of metal from the rail head. The third operation takes more of the upset metal from the top of the rail head, and the final operation consists of smoothing up the head through the weld area.

With the equipment now in service, as many as 166 joints have been completed in a working day, involving two eight-hour shifts. A force of from 16 to 18 men is employed.

The welded lengths of rail are unloaded at the site of laying and are joined by Thermit pressure welds, making continuous rails up to a mile or more in length between insulated joints.

The D. & H. experience has demonstrated that long rails without expansion gaps are entirely practical under the main line conditions and other service in which they have been used. Most of the installations have been made in stone-ballasted tracks, but 14 track miles have also been laid in cinder-ballasted tracks, and have gone through a period of hot weather without presenting difficulties.

The rail welding has been done under the direction of H. S. Clarke, engineer, maintenance-of-way. The early developments in flash welding were carried out by the General Electric Company, Schnectady, N. Y., while all of the later developments, including the arrangement of the portable equipment, have been developed by Sperry Rail Service, Inc., Brooklyn, N. Y.

First grinding removes the upset metal from the two side faces of the rail head.

Motor-Block Welding Saves Money for Customers

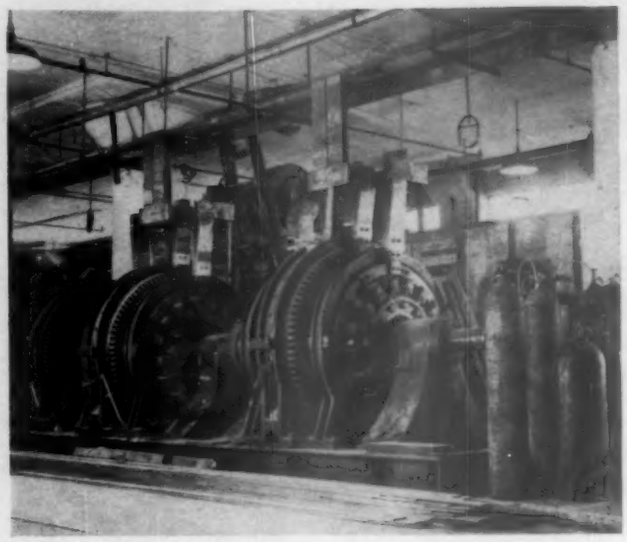
Steady development of an unorthodox method of welding valve seats in heavy power units has brought the National Welding Co. of Denver. Colo., considerable business in the past five years. The most prominent among large western trucking fleets who endorse the National system are the White Truck Co., Denver Cab Co., and the Caterpillar Tractor Co. The valve seat process, tested and proven in these large fleets, has become a regular feature of their maintenance.

When any truck begins to show signs of valve wear, it is turned over to National Welding for valve reconditioning. The block is dressed down far beyond ordinary practice and each seat is rebuilt with cast iron, utilizing either acetylene, carbon arc or "electro-weld," depending on the hardness of the original casting. A new bonding process, about which the originators are secretive, insures a valve seat which will substantially outlast the original seat.

"All doubts about valve replacements being less trustworthy than the factory castings have been removed by the results we have obtained," said Mr. Flader, the president. "We have found the idea applicable to any type of motor unit. An average job costs around $24 and saves as much as $175 in later repairs and lost service."

A practical illustration of valve replacement value is shown by its use in heavy road-building and construction tractors operated by the Colorado division of the Caterpillar Tractor Co. An estimated saving of $1500 has been effected during the last two years on all units rebuilt by National. The cast-iron seats have stood up under the hardest-wear jobs the company has encountered.

"We have had welders from all over the country drop in," Mr. Flader stated, "Most of them said it couldn't be done. We've been steadily improving the general technique of this system until now we are qualified to handle any size, or make of heavy-duty truck. Quite a bit of the work is now being done on farm machinery."



Bus-bars in the hangers are about to be attached to the vertical feeders—Connections to the 10,000 amp. generators are bolted to facilitate removal should repairs be necessary.

Pioneer application of low-temperature alloy for

Brazing of Copper Bus-Bars

★ Part II—How the brazed joints are made —Higher corrosion resistance, improved electrical conductivity and substantially lowered costs are achieved.

By R. A. GOELLER

Vice-President, Hatzel & Buehler Inc., New York City

In the first installment of Mr. Goeller's technical paper, which was published in the December 1937 issue, pages 34-35, the author outlined the general problem presented in constructing the bus-bar structure for a 36,000-amp. electro-galvanzing plant in a large tube mill. After decision to investigate possibilities of using low-temperature brazed joints, the contractor arranged for tests of sample brazed joints in a recognized testing laboratory. Fall-of-potential and tensile tests were made and a report prepared for the contractor and customer.

Three outstanding facts are obvious from this report:

1. That the two pieces of 6 in. x ½ in. copper with a 1½ in. lap, joined by low temperature brazing alloys had a lower fall-of-potential by 0.2 M.V. than a sample of similar length without a splice.
2. The tensile strength of the joint was extremely high, as indicated by the fact that the two 6 in. x ½ in. pieces parted at 68,500 lbs.
3. A lap of 1½ in. on the 6 in. x ½ in. bus bar was ample—both mechanically and electrically.

With the result of these tests before him, F. M. Darner, chief engineer of Steel and Tubes, Inc. decided to proceed with the brazing method. Then it became necessary to order gas equipment, torches, and low temperature brazing alloy, flux, etc. Due to the mass of metal in each joint, it was decided to use a two-flame tip and three cylinder oxygen and acetylene manifolds, so as to provide an adequate flame and uniform pressure for the longest possible time.

It was decided to use Alloy No. 1 since it could be obtained in 0.010 in. thickness and had a low melting point of 1300 deg. F. which meant low gas consumption. This is a low temperature brazing alloy consisting of 80% copper, 15% silver and 5% phosphorus. In the application of the heat to the joint, phosphorus, which is present for the purpose of lowering the melting point, and which has a boiling point of only 550 deg. F., may be reduced slightly in its percentage with the result that a higher temperature will be required to melt the joint apart.

In New York City a number of electricians have been trained by the local union and have obtained permits for this type of work. A call brought an unusually competent man, who, after making a few sample joints, a matter of only an hour or so, started the actual work and from then on it was carried through to completion without hitch or complication. The method of making the joint was simple.

Fabricating the Joint

1. The adjoining faces of the lap were cleaned with emery-cloth or with a power-driven sander.
2. The bars were lapped three times their thickness.
3. The lap distance was then scribed on each piece.
4. The pieces thus prepared were assembled, inserting a sheet of brazing alloy between them. This strip of alloy was cut about 1/32 in. shorter than the joint dimensions

A slightly different scheme for connection of the generator to the overhead delivery bus-bars.

and a thin coat of flux applied to both sides. Pressure applied during heating insured that the alloy would flow to all portions of the joint.

5. The assembly was then clamped with ordinary C clamps, screwed up as tightly as possible.
6. The joint was heated by an oxy-acetylene torch until the alloy ran out at the edges.

In special cases a brazing alloy was used in rod form, similar to solder, to fill voids that could not be handled otherwise.

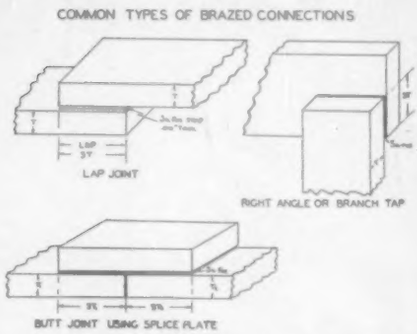
One important point in making joints in heavy bus bars, having a multiplicity of laminations, should be stressed here; it is the fact that each pair of bars has to be joined separately. This led to some fabrication problems which were serious only in respect to the cost and which offset to some extent economies gained in other directions.

Acid Corrosion

At the plating tanks a number of situations arose where brazed joints provided a method that was free from acid corrosion and subsequent deterioration normally present in a clamped or bolted joint. Thus there were no bolts or clamps to corrode or produce galvanic reaction of dissimilar metals under acid conditions to develop failures.

Space saving was another factor in favor of the brazed joint, because there are no bolt heads or clamps to contend with, and on the tanks proper a serious problem was solved where the anode bus, consisting of three 6 in. x ½ in. bars in parallel had to be carried along between the top edge of the tank and numerous metal supports at right angles thereto. Within the tanks, too, it was necessary to splice some 6 in. x 1 in. cathode bars which after fabrication were rubber coated.

The diagrams below illustrate several of the joints used by us on this operation. Included is a sketch of the method using splice plates which permits the busses to be aligned at the joints rather than off-set. In long runs and in exposed locations, this method is often desirable. Method of making a right-angle joint or tap is also shown.



Three common types of brazed joints.

It is quite obvious too, that changes in direction, or taps at more or less than 90 deg. can be easily accomplished and a large amount of flexibility is provided in assembly through the ability to slide one bar over the other, until properly positioned and then complete the joint. Joints in laminated busses with this method do not have the bulky appearance of the old method and in discussing the possibility of adopting this type of joint with an engineering representative of a large chemical concern, wherein it was pointed out amongst other things that "the joint had a minus drop and greatly increased opportunities for radiation," he dryly turned and remarked, "So what you are trying to sell us is a bus bar system with aerated joints and if we put in enough joints we will be able to cut our voltage down to zero." We got the job and used the new type of joint, but it is doubtful if we will ever live down our high pressure sales talk in trying to put the new method across.

In making joints of this character, where heat is employed, expansion of the metal is a factor and therefore care must be taken in fabrication to allow for this and the subsequent contraction. The question has also been raised—why not use a butt-weld? The answer is, it can be done but practical field difficulties do not warrant it, for it would be necessary to machine the ends, have special clamps to hold the bars in position and then put them under pressure. Expansion and the small margin of surface to work with, all indicate the lap method unless there are special conditions to be met with.

While the advantage of a joint impervious to corrosion, mechanically strong, having no greater resistance (less in fact) than a solid piece of copper and which will not change during the life of the joint are advantages of paramount importance, the question naturally arises, "What does this method cost over the old one of bolts or clamps?"

Copper Saving

The saving in copper at the joints was unusual and based upon a 6-in. lap on the 6 in. x ½ in. bars for the clamping or bolting method as against a 1½ in. lap used for the brazing process (for the smaller sizes in proportion) we have arrived at an estimated saving of 1717 lbs. or $309.06 ($.18 copper base).

An analysis indicated that we had an approximate total of 4,233 sq. in. of brazed joint, and against this we had the following material costs:

Acetylene and oxygen	$232.00
Low melting alloy and flux	87.50
Welding torch and accessories	149.23
Total material cost	$468.73

The cost of material per square inch of joint was $0.11. On the joints for 6 in x ½ in. bus, having 1½ in. lap, which were the greatest number, we had an average cost of material of

Joints in the anode bars which passed through the tank had to be insulated by coating with rubber. The 1 in. by 6 in. bars were notched 3 in. by milling.

TABLE 3—Comparison of Field Costs on Bus-Bar Construction

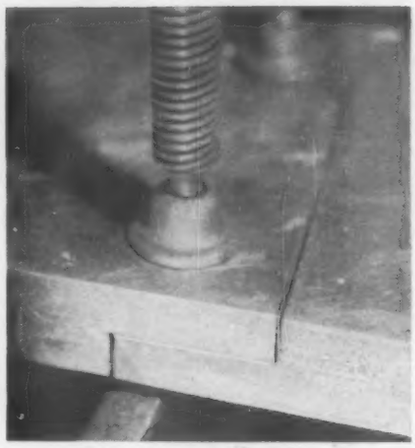
Labor, welding and assembly (based on $1.70 per hr. plus 20% supervision)	$ .52
Oxygen, No. 1 alloy, flux	.99
Misc. expenses	.03
Copper ($.18 base) bars—lapping 1½ in.	.26
Total field cost	$1.80
Cost of bolted joint on same size bar but with 6 in. lap—(using drilled holes)	
Labor rate as above—drilling 10—½ in. holes with power driven press (5 in each 6 in. x ½ in. bar)	$2.00
Labor for assembly	1.05
(5)—½ in. x 1½ in. steel bolts, nuts, and washers	.40
Copper ($0.18 base) lapping 6 in.	1.03
Miscellaneous expense	.05
Total field cost	$4.53
Cost of similar joint when brazed	1.80
Estimated saving by brazing	$2.73
Cost of bolted joint on same size bar with 6 in. lap but using punched holes:	
Punching holes (10)	$1.20
Labor—extra filing	.30
Labor for assembly	1.05
5—½ in. x 1½ in. steel bolts, nuts, and washers	.40
Copper ($0.18 base) lapping 6 inches	1.03
Total field cost	$4.03
Cost of similar joint when brazed	1.80
Saving by brazing method	$2.23
Cost of clamped joint when using one pair of 6 in. x 6 in. cast iron clamps:	
Labor for assembly	$ .75
1 pr. cast iron bus clamps	4.85
Copper ($0.18 base) lapping 6 in.	1.03
Miscellaneous expense	.05
Total field cost	$6.68
Cost of similar joint when brazed	1.80
Saving by brazing method	$4.88
Summary of costs of the various types of joints:	
Brazed joint	$1.80
Bolted joint with drilled holes	4.53
Bolted joint with punched holes	4.03
Clamped joint—(cast iron clamps)	6.68

$.99 per joint. For a joint in 6 in. x ½ in. bus with 1½ in. lap we had the overall field costs shown in Table 3. The labor cost per hour was the same in each case, $1.70 per hour plus 20%, which includes field supervision such as foreman's time and other non-productive items, but does not bear any burden for overhead or allowance for insurance, taxes, etc. It will also be observed that the field cost of material per sq. in. of joint on ½ in. x 6 in. bus was 71% more in the field than in the laboratory, ($.064 to $.11 per sq. in.) and is accounted for largely by the greater consumption of gas under actual working conditions.

On our second bus-bar installation a slightly different type of brazed joint was used. In this case, the bars were butted and a splice or fish plate was brazed on one side. The plates were cut from the short ends of the regular bars and were made somewhat longer than was necessary to provide a three times the thickness lap on each bar. There was no necessity for this increased length, from our point of view, however, it did provide more space to attach the four C clamps.

This job was not as extensive as the first inasmuch as there were only 10 tons of bus bars assembled. It was an excellent opportunity to test some of our theories regarding this type of fabrication. There was an entirely different crew of workmen on this job, and we felt that if everything went smoothly here, it could be safely stated that no special workmanship is required for the actual brazing operation.

When we were ready to join the bars, the oxygen manufacturer sent one of their service men to instruct our man how to handle a welding torch. More time was spent on the proper method of setting up the regulators, hose, and torch than on the actual brazing operation. A sample joint of two 3-ft. pieces was made up by our man with the service man offering suggestions. When completed, the joint was cut apart with a hacksaw in several places. The fusion of the No. 1 alloy strip was complete and the workman was quite pleased because he had been able to do a satisfactory job with little assistance. The superintendent felt that it was not necessary to make up any more samples, and on the next day production work was started and carried on to completion without any trouble.



Assembly of the anode bars showing how strips of silver alloy were placed —Ordinary "C" clamps were used on all types of joints.

Other Possible Applications

While the joining involved in these installations primarily had to do with bus bars carrying heavy currents at low voltage, it also has a broad field of application where the distributing systems operate on higher voltages at lower currents and has a large field of use in power plants and sub-stations. In the first installation, for instance, this type of joining was applied very successfully in the primary and secondary bus-bar installed in the substations supplying power for this project.

It seems inevitable that the joining of bus-bars by the use of low temperature brazing alloys will grow rapidly when its possibilities are more generally understood. Its application to electrical uses is just one more indication showing the interdependence of industry and how the results of research conducted by men in one industry, may open up new fields of application, thus making available methods having broad commercial possibilities.

Arc Welded Engine Bed Repair

Down time due to breakage of production machinery is a costly factor in plant operation. Especially is this true when the break down involves equipment which is essential to processing or where spoilage of finished product is involved.

The Falls City Brewing Co., Louisville, Ky., was recently confronted with such a situation when the heavy bed of an engine used to drive a 200-ton ice machine compressor broke. This equipment is used both in manufacture and also in keeping the finished product until delivery is made. Since a sizable amount of money was involved, it was essential to get this unit in working order at the earliest possible moment.

View of finished weld in cast-iron engine base—A total of 200 lbs. of shielded arc electrodes were used.

Approximately 150 holes (¼ in.) were bored to place drive-in type studs—Tapping holes was not necessary.

Consideration of a new engine bed involved a great loss of time and also expense. It was estimated that a new bed installed would cost in the neighborhood of $18,000 in addition to the delay in getting delivery and installing it. The alternative of welding the break offered itself as a solution favorable both from a cost consideration and as a time saver. Accordingly E. D. Smith Co., welding contractors of the same city, were given the job of making the repair.

The first step in preparation was to vee out the area of the broken section with an air hammer. All metal well beyond the line of the break was removed so that there would be no possibility of it continuing further during welding or after its completion. Following this step an electric drill was used to bore approximately 150 (¼-in.) holes for placing studs in the prepared area. They were positioned in straight lines on 1-in. centers and staggered in succeeding lines. The studs were of a special drive-in type with a beveled screw. Since the stud must fit tight in the bottom of the hole, this type saved much time, for the necessity of tapping the holes was eliminated. The final step in preparation was to carefully clean the area of the break of all rust and grease. The vee'd out section after preparation was about 3 in. wide in section and 24 in. long at the point of greatest length.

Outside appearance of completed weld in heavy engine bed—Total job time, 400 hrs.

The welding electrode selected for the work was Airco No. 77, a shielded arc type which is especially adapted to welding cast iron. Weld deposits with this electrode are machinable, with tensile strength and ductility greater than that of cast iron. In operation, it produces a sound weld free of porosity and well fused with the parent metal. A light slag results which is easily removed.

In making the weld, the machine was set for 90 amp. with 20 volts at the arc and straight polarity. First, a bead was laid around each stud to fuse it firmly to the parent metal. Following beads joined studs to each other, until an area of weld metal covered the entire face of the break. It should be noted in carrying out work of this kind that a bead of not more than one inch should be laid down in one place and the area of operation varied so that a heated portion has a chance to cool before more welding is done at that spot.

Another point to keep in mind is that the slag should be carefully removed before another deposit is made, since inclusions of such slag in the weld will weaken it. The only treatment given the weld metal after deposit was a light peening which fol-

lowed removal of the slag. Two hundred pounds of electrodes were used in the weld and the job was completed in 400 hours, which included chipping out the break, setting the studs and making the weld.

Here, again, is a good example of the savings that can be made with the welding process. Not only was a saving made in the cost of making the repair, as compared with cost of replacement of the broken part, but also the saving of down time in a busy plant and elimination of product spoilage due to the breakdown of an important machine.

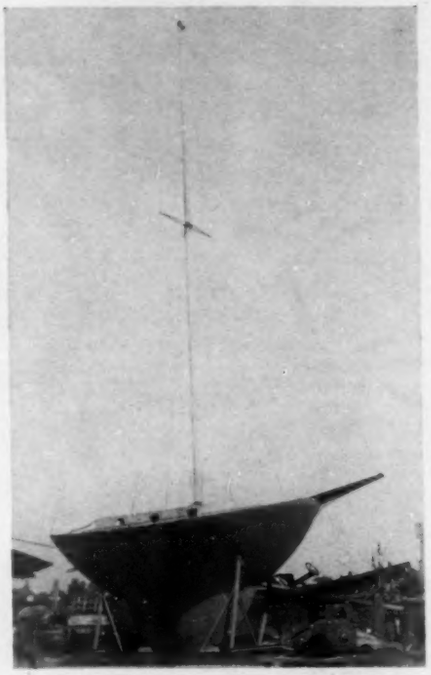
Pleasure Sailing Craft Is All Welded

A welder in El Monte, Calif., is a lover of boats. Pursuing his hobby, he recently constructed the trim, all-welded, deep keel, auxiliary cutter-type sailing vessel shown in the illustration. This craft has an over-all length of 37 ft. It is 11 ft. from keel to deck edge, 10 ft., 3 in. at its extreme width, and draws 9 ft. of water. It has a total weight of six tons of which three tons is lead ballast. The steel plate for the hull is 3/16-in. thick and is electrically butt welded throughout. All seams in the hull were welded both inside and out.

Practically no difficulties in contraction and expansion were encountered, and few tacking or intermittent welds were found necessary. This was due largely to the fact that what warping occurred was taken up in the natural curves in the plates forming the hull. This, through practical experience, was easily controlled by the designer and builder in laying out the work. Bare welding rods of 3/16 in. and 5/32 in. size were used.

The keel has an extreme length of 16 ft. and is 5 ft. wide at the center. Its perfect symmetry is made possible by the smooth welded butt joints. This feature, which also applies to the entire hull, provides less resistance to the water than riveted joints, and, it is believed will provide greater speed for the craft.

The rudder is an integral part of the keel, and by its inverted position, can be operated with little danger of gathering seaweed, kelp, or other obstructions. Worthy of note is the fact that only by means of welding could a rudder of this efficient type be built into the keel. The decking, also welded, is of 12 gauge sheet metal.



All-welded pleasure craft designed and built by a welder whose hobby is boats.

The hull has no ribs or other reinforcing members, its strength, according to its designer, being obtained by the contour of its spherical shape and the smooth, uniform curves obtained by its welded construction. By bulkheading, all space in the bottom of the hull is utilized for water, fuel, etc. A tank holding 65 gal. of water is situated aft. This also forms a base for the auxiliary motor. Nearer the stern, and at a higher elevation, is a 40-gal. gasoline tank. This arrangement and location of the fuel tank provides for gravity feed to the motor and permits convenient filling of the tank from outside the hull.

The cabin is 16 ft. long and 5 ft., 6 in. wide, with 6 ft., 2 in. of head room. In the cabin are three bunks, a single one on each side, and a double one in the foreward stateroom. The cabin is covered with 12 gauge sheet metal, all seams being welded on one side only. Port-hole frames are of aluminum. All standing rigging is of oil tempered 3/8-in. spring steel wire.

The mast extends 46 ft. above the deck, 26 ft. of which is of 6-in. light weight welded tubular steel, and the remaining 20 ft. is of hollow airplane spruce. The base of the mast is stepped on the roof of the cabin and secured to a welded pedestal, which, by a special arrangement, is built into the framework of the cabin, eliminating the necessity of extending the mast through to the keel as is the usual practice.

When auxiliary power is desired, the craft will be driven by a 17 hp. gasoline motor. The propeller has a 12 in. x 8 in. blade of stainless steel. All shafting is of stainless steel.

Larry Luke, welding supervisor and for 12 years associated with Prow & Leffler, a pioneer welding concern of El Monte, Calif., is the designer and builder of this attractive welded boat. Mr. Luke's method of fabrication is said to be covered by patents. The boat is almost ready for launching, which will take place in the near future at Craig's shipyard in Wilmington, near Los Angeles.

Electric Welding of Heavy Trailers

Two of the largest electric welding jobs in Colorado were completed recently by the Smith Welding & Engineering Co. of Denver. Arc-welding proved to be the solution of many of the difficulties encountered in construction of heavy truck semi-trailers.

Contracts were let by the Gallegher Transfer Co., Denver moving firm, and by H. Switzer & Co. specializing in heavy machinery transportation. These called for two "super-tonnage" jobs, one a semi-trailer of 25-ton capacity and one a dolly trailer of 35 tons on 12-wheel axles. The cost of the dolly trailer was approximately $4,000, exclusive of tires and paint.

Built with a channel and I-beam frame with straight cross-members, the big dolly trailer is 30 ft. long, with around 26 ft. of pay-load space. It will be used to carry threshers, tractors and other heavy farm machinery. The entire frame is electrically welded, with particular attenion being given to the difficult cross-members.

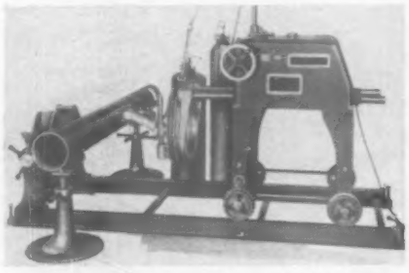
The semi-trailer, built for H. Switzer & Co., cost about the same, because of the obstacles encountered in building a drop-frame of such magnitude. It is an 8-wheel job, capable of hauling mixers and heavy mining machinery for long distances, over mountain roads.

These two giant trailers attracted considerable attention to the Smith Welding Company, one of the oldest in Denver. This firm has been building heavy haulage trailers and carriages for the past ten years.

New Equipment Developments - - -

Improved Torch Cutting Machine

The Oster Manufacturing Co., Cleveland, Ohio, has just announced an improved model torch cutting machine which supersedes the original model No. 212. The new machine, known as the No. 222, which duplicates in design any pattern required for pipe welding jobs, does not require the use of cams, templates or special fixtures and it is claimed that the surface it produces has the appearance of a lathe tool cut.



Model 222 Oster torch cutting machine

The cutting torch is guided by a mechanism which duplicates the motion of a torch held in the operator's hand. It will cut pipe from 2½ in. to 12 in., making tees, reducing tees 90 deg., branch reducing tees 45 deg. to 90 deg., elbows, miters, Y's and blunt bull plugs, as well as hole cutting. The case containing the generating mechanism is mounted on four legs which are equipped with flanged wheels running on a track. The pipe is centered in a vise and supported on roller pipe rests, if the length requires the additional support, for straight cutting, for butt or tee welding. The adjustable torch carrier is brought in the proper position. If a hole is to be cut in the pipe, it is placed at right angles to the torch carrier, on the roller pipe rests.

The settings of the generating mechanism are regulated by positioning a rotating beam or lever which operates a reciprocating slide. The beams are marked to show the settings for the various sizes and types of cuts so that it is a simple matter for the operator to make the correct setting. The reciprocating slide, in turn controls the movement of an oscillating lever which reproduces the movement in the torch carrier. The method of imparting movement to the rotating lever is through a hand wheel, located at the side of the generating mechanism case, which also produces the drive for rotating the torch carrier ring around the pipe. The operating hand wheel is located conveniently for the operator where he can clearly see the work as it is being done.

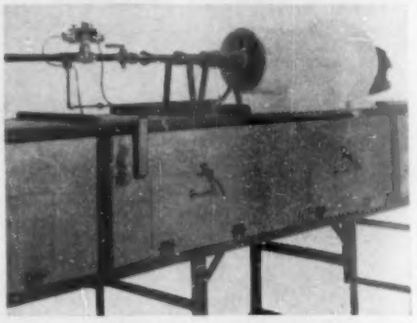
The improved model machine is said to have been greatly simplified with a greater saving in time over the methods employed by the original machine. The floor space occupied by the machine, including the track unit is 3 ft. 4 in. by 9 ft. Its net weight is 3,000 lbs.

- - -

Continuous Type Welding Electrode Dryer

The Steiner Oven Co., 30 Locust St., Bloomfield, N. J., has recently announced a complete conveyor type drying equipment for coated welding electrodes. Simplicity of construction of moving parts and freedom from operating difficulties are emphasized in the design of these ovens which have been installed in the plants of large producers where they are arranged to take rods direct from the coating machines and deliver them properly dried and ready for inspection and packing.

Electrodes are carried on two parallel roller chains and make a single pass through three separate oven sections,

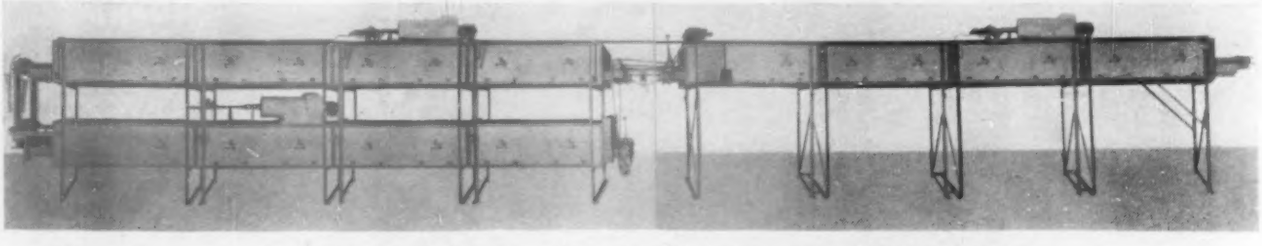


Close-up of gas fired air heater—Heat fan gives rapid flow and recirculation of heated air making for economical operation

each 30 ft. long. These sections can be mounted in line for straight flow of rods; or, if necessary to save floor space, the third section can be placed below the second section as shown in the illustration. In this case a vertical conveyor is furnished to carry rods down from the second to the third section.

Heat is supplied by a gas-fired air heater with recirculating fan mounted on the top of each of the three sections. Automatic temperature controllers on each heater can be adjusted to maintain any desired heat as required by the size or type of electrode. Provision is made for increasing the humidity in the first section.

There is a separate conveyor chain assembly inserted in each oven section. These are connected between sections by a short transfer chain which carries rods into the open air for inspection and rapid escape of water vapor. The entire conveyor mechanism is driven by one motor through a variable speed drive. Additional speed control is provided by driving the conveyors in the second and third sections through three-speed gear transmissions. Drying time can be adjusted from a minimum of 12 min. to a maximum of 170 min., thus permitting the proper



Straight line assembly of continuous type drying oven for coated electrodes

drying time to be selected for every size and type of electrode.

In operation the electrodes are spaced from ¾ to 1½ in. apart on the conveyor of the first section where they are pre-dried by a low heat with added humidity. As the conveyor of the second section runs at a slower speed than that of the first section, the electrodes are bunched closer together during the transfer between sections. The amount of bunching may be controlled by adjusting the relative speeds of the two conveyors.

A simple mechanism installed at two points in the second and third sections gently lifts and turns over the rods to equalize the drying on all parts of the coating. The three-section oven is designed to dry continuously the entire output of the highest speed coating machine. A single 30-ft. section can be supplied, however, to fill limited production requirements.

Anti-Static Sandblast Hose

A new construction of sandblast hose designed to overcome the accumulation of static has been introduced by The B. F. Goodrich Co., Akron, Ohio. While this hose does not eliminate static, it does provide a ground wire in the heart of the hose wall, so that discharges of static tend to ground through the wire rather than through the body of the operator. Static punctures, instead of penetrating entirely through the hose wall, with disastrous results, reach only as far as the wire.

Wall thickness of this new sandblast hose is somewhat greater than the standard type. Construction consists of a tube, one ply of fabric, wire coils embedded in rubber of the same quality as the tube, then three plies of fabric and the cover.

Goodrich anti-static sandblast hose is available in sizes ranging from ¾ to 3 in.

Improved "Sure-Grip" Holder

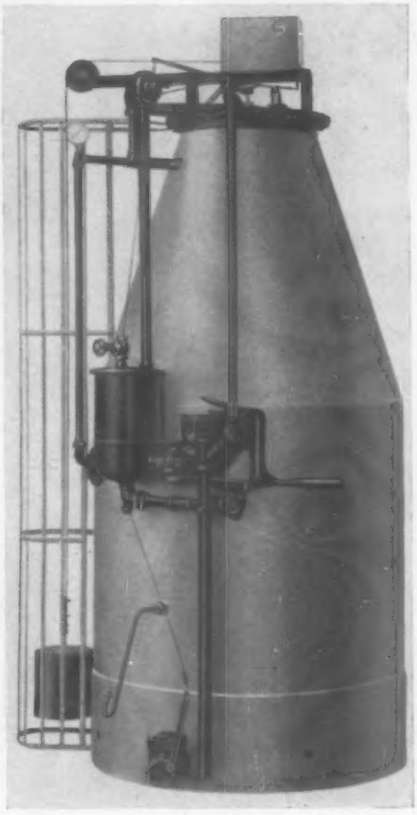
The Wells Mfg. Co., Los Angeles, Calif., manufacturer of the "Sure-grip" electrode holder, has added a new feature to its holder. A guard and heat shield about five inches in diameter attaches to the front of the handle. This guard has five sides and ordinarily, when the holder with the rod inserted is laid down, three positions will prevent arcing, said to be a practical improvement for many types of work. This also protects the operator to some extent from the heat.

New Airco Double-Rated Acetylene Generators

Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y., announces the addition of two double-rated stationary acetylene generators to its line of oxy-acetylene equipment. These are available in 300-lb. and 500-lb. carbide capacities and have rated delivery of 600 cu. ft. and 1,000 cu. ft. of acetylene per hour, respectively. Both are listed by the Underwriters' Laboratories.

Based on the design of the Airco-DB single-rated generators, these units lend themselves to multiple use due to the small floor space required. The 300-lb. generator shell is 42¾ in. in diameter and the 500-lb. shell is 54¾ in. Heavy gauge sheet steel is used and hot galvanized inside and out to give maximum protection against corrosion. Overall height of the generators is 125½ in. and 137 in. respectively. The design makes the best use of the space available with all parts accessible for inspection or cleaning. Pressure control, simple and effective, is located at the top of the generator where water and lime cannot hinder its efficiency.

Carbide feed does not depend on gravity, but is displaced from a feeding disc which is positively driven by a gravity motor controlled by the pressure control. It is claimed that even if the pressure control fails, the motor will stop and feeding will cease. A reducing valve or regulator is unnecessary, the makers say, making it possible to maintain higher line pressures in long plant pipe lines without exceeding the maximum safe acetylene pressure.



Stationary acetylene generator has fool-proof method of feeding carbide.

Relief valves are of large and reliable construction. Hydraulic back-pressure chambers are standard and are filled and washed automatically every time the generator is recharged. A mechanical double-action check valve serves as an added protection against flashback in the line, or any reverse flow which would tend to force the water out of the back-pressure chamber. Excess flow of gas into the lines is also prevented. Another safety factor included is the sludge discharge which is forced out by the existing pressure in the generator without opening the generator to the atmosphere.

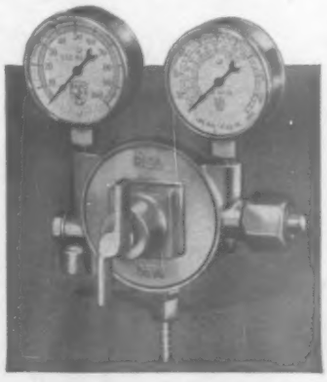
Full description and prices of this equipment can be obtained from the company at the address above or any of its district offices.

New Two-Stage "Regolator" Announced

The Bastian Blessing Co., 278 E. Ontario St., Chicago, announces the Regolator, a new two-stage regulator built into a compact forged brass body for the accurate control of oxygen, acetylene, hydrogen, nitrogen and other high pressure gases. It combines a positive, direct first-stage nozzle type regulator and a second-stage inverse or stem type regulator. It is claimed that this patented combination of the two types of regulators results in a perfectly constant flow of gas, regardless of cylinder pressure fluctuations from full to empty.

According to the makers one of the design developments is a new triple-filter cartridge-type strainer with a filtering area at least 17 times as great as that ordinarily used, which removes rust, dust and dirt which are the common causes of regulator ailments. It also serves to dissipate the heat of compression caused by quick opening of an oxygen valve and, it is claimed, eliminates the possibility of seat ignition.

Additional features which the maker points out are: Large streamlined gas passages for free flow of gas; first stage regulator setting of 150 lb., which can be easily adjusted to as low as 75 lb. by the operator; second stage regulator adjustable from 0 to 75 lb. delivery pressure; constant delivery pressure well below 1 lb. easily maintained; double springs and an unusually large second stage diaphragm (3⅛ in.) assure accurate full range control; large easy-grip adjusting screw to facilitate sensitive control in setting desired pressures; a safety release off the first stage outlet to provide a double margin of safety; reversible seat in the first stage; either stage repairable without disturbing the other stage; only a screw driver, wrench and vise needed for replacing seats or diaphragms.



Two-stage "Regolator" provides constant flow of gas, regardless of cylinder pressure changes.

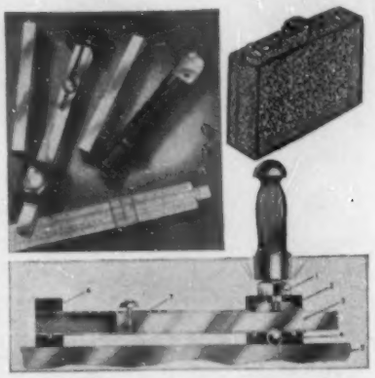
The Regolator, its makers say, is adapted to welding, cutting, silver soldering, brazing, metal-spraying and many other high-pressure gas control applications giving better results, because the flow of gas remains constant—torch flames cannot become oxidizing or carbonizing. Frequent adjustments are unnecessary and much valuable operator time is saved. Prices and full description can be obtained from the manufacturer at the above address.

Portable Brinell Tester for Field Work

A light-weight, portable Brinell instrument that can be carried to the job is said to simplify metal hardness tests in the field, remote from laboratory facilities and around industrial plants. According to the manufacturer it can be used in close quarters and can be applied to parts and equipment, the size of which have, heretofore, made testing difficult, and expensive and sometimes virtually impossible. It eliminates the necessity of dismantling equipment to be tested and transporting specimens to the laboratory.

Known as the Telebrineller, the instrument was developed by a well known railroad rail maintenance organization. Its simplicity, convenience and the ease with which it can be carried are indicated by the fact that the combined weight of the outfit and carrying case is only 6-1/2 lbs. Besides its use to test rail ends it is being used where an accurate knowledge of metal hardness is a factor in safety and continuous operation. A number of oil refineries are said to be employing it to test the parent metal adjacent to welded joints in alloy steel pipe in high pressure and hot oil lines. It is claimed that welding and vibration in use harden the weld zone beyond the safety point in heat exchangers, castings and other equipment.

The outfit is composed of the Telebrineller instrument proper, a bar of known hardness, a microscope with a scale etched in its focal plane and a slide rule, packed with extra test bars and impression balls in a small case. The instrument itself consists of a metal tube supported in a soft rubber head *(2)* and a rubber spacing block *(6)*, the tube holding the bar of known hardness *(3)*. An anvil *(1)* in the top of the rubber head rests directly on the bar. Below the bar an impression ball *(4)*, secured in a narrow aperture in the base of the head, comes in direct contact with the metal to be tested. The spacing bar *(7)* holds the bar in a clear area for each test.



With the Telebrineller, tests of metal hardness in the field are greatly simplified.

For literature fully describing the Telebrineller and its use write to Teleweld, Inc., 630 Railway Exchange Bldg., 80 E. Jackson Blvd., Chicago, Ill.

Two New All-Position Murex Electrodes

Two new electrodes for manual arc welding have been announced by the Metal & Thermit Corp., 120 Broadway, New York City, exclusive sales agents for American Murex Corp. The new Murex Vertex electrode is a reverse polarity rod designed for welding mild steel in flat, vertical and overhead positions, and is used for general shop work, where positioning of parts during welding is not practical. It is also employed in structural welding, such as, shipbuilding, bridge and building construction.

The new Murex Genex electrode is an all-around type that may be used in all positions and readily bridges gaps between plates where assembly fit-up is poor. It is a straight polarity electrode.

These electrodes serve to round out the Murex line, which includes some 20 different types of welding rods for

mild steel fabrication, the repair of manganese steel parts, the building up of wearing surfaces, and for welding a number of the new high-strength, low-alloy steels. The entire line is described in a recently published pocket size pamphlet, which may be obtained by writing to the Metal & Thermit Corp., 120 Broadway, New York City.

Victor Announces New "Gas-O-Dome" Regulator

The Victor Equipment Co., 844 Folsom St., San Francisco, Calif., has placed on the market the "Gas-O-Dome" regulator which has been developed for oil refinery laboratories or wherever small volumes at extremely high delivery pressures are necessary. It is designed for working pressures ranging up to 5,000 psi. and for primary pressures exceeding 5,500 psi. and can be furnished for remote control operation, which is of particular interest to many laboratories. The illustration is the type which uses the primary pressure for delivery pressure control. Another type is produced utilizing a separate source of high pressure gas (such as nitrogen) to actuate the diaphragm and this model, it is claimed, can be used for remote control.

The delivery pressure adjustments, it is stated, are absolutely accurate over the entire pressure range and within fractions of a pound. The diaphragm arrangement is full floating between equalized gas pressures. For high delivery pressure ranges, the elimination of springs and the even distribution of the loading pressure, results in perfect delivery pressure accuracy and maintenance, it is claimed.

New "Gas-O-Dome" regulator features a simple and sturdy working mechanism.

The regulator illustrated shows the duplex valve arrangement for loading or unloading diaphragm pressures. The working mechanism is of extreme simplicity and sturdiness to meet adequately the most severe operating requirements. The manufacturer states these regulators are now being used by several of the leading oil companies and research laboratories and complete data will be furnished on request to the above address.

New Helmet Goggles for Eyeglass Wearers

Eyeglasses need no longer be an annoyance to welders equipped with the new Chambers cover glass type helmet goggles. The eyecups are particularly designed to fit over the eyeglasses comfortably, giving full protection to prescription lenses.

By means of adjustable arms and semi-rigid method of joining eyecups, the goggles can be raised or lowered without striking or interfering with the eyeglasses. This, plus the elimination of elastic headbands, gives the welder who wears glasses the maximum in goggle comfort and convenience. Fitted with standard 50 mm. lenses.

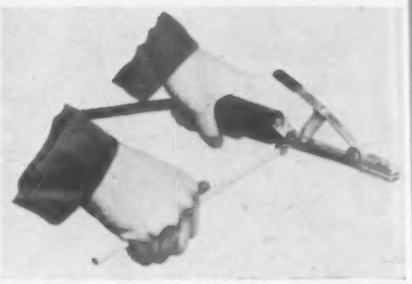
Further particulars may be obtained by writing the manufacturers. Carter-Lockard Co., 225 W. 11th St., Los Angeles, Calif.

New 14-oz. Lincoln Electrode Holder

A new light-weight welding electrode holder has been announced by The Lincoln Electric Co., Cleveland, Ohio. It is designated "Type ST," weighs only 14 oz. and has a current capacity of 250 amp. continuously.

Light weight is obtained by use of arc welded formed steel parts. A simple type of connection assures positive contact and elimination of loose connections. All contacts are arc welded. Cable connection is made with an easily operated clamp, which can be tightened or loosened without tools, by inserting a welding electrode through a hole in the square head of the clamp cap screw and applying leverage.

Other features which the maker states are: reduced overall width for easier welding in corners and other



Lincoln electrode holder weighs only 14 oz. and features a novel easily operated clamp.

confined places; rounded corners at important points to prevent arcing with the work; heavier copper jaws, grooved for vertical, overhead and flat welding; hollow fibre handle proportioned to fit the hand; fully insulated thumb lever and non-groundable sturdy spring; accommodates any size electrode up to and including ¼-in.

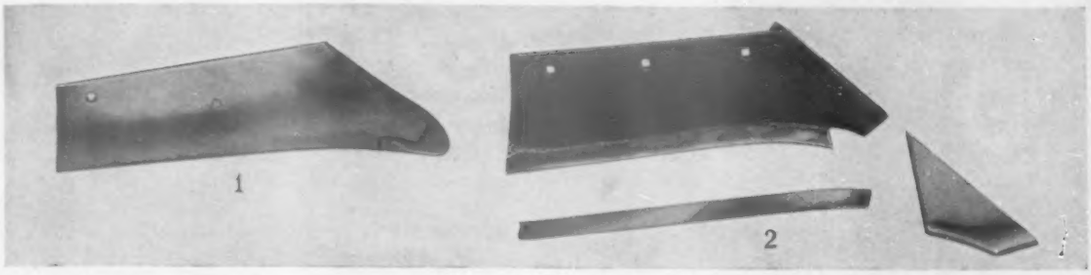
New Plow Share Reclaiming Units

Plow share reclaiming units have filled an economic need in agriculture. The new Wiese drop forged point employs an alloy groove on the under side to give long wear. It is constructed with the throat forged heavy to give long wear in the throat section of the point and a thin tapered flange extends over the worn face of the share.

The flexibility of the new Wiese drop forged point is possible because the point and cutting edge are two separate and detached units. It is easy to line them up on the various types of plow shares. It is said to require less welding rod than any other type of point and is quick to apply.

In all cases it is unnecessary to do any dressing or cutting of the plow share itself before fitting on the drop forged point. In some cases all that is necessary is a small amount of grinding or cutting off with the arc on the rounded edge. The landside portion has a rounded side allowing the welder to get in with the welding rod at this point. The total amount of welding bead is 8 in. to apply the point to the share. This is done in most cases with 5/32 in. or 1/8 in. welding electrode in a single bead.

This point design is said to give much greater strength than a butt-welded point where there are rocks in



Drop forged plow share reclaiming units have points equipped with an alloy groove on the bottom side.

the soil, because it is welded to the plow point proper. The point measures 8-1/2 in. in overall length. It is manufactured under U. S. patents 2,013,818 and 2,051,234.

This new drop forged point can be used on plow shares needing a point only, as shown in the illustration (No. 1). In some cases a small piece of steel welded in the throat may be necessary. This can easily be done with either the electric arc or an oxy-acetylene torch. The Wiese points are made in two types—one type of carbon steel for hardening after application, and the other type of heat-treated steel which does not require hardening after welding.

The cutting edges to be used with these points and the method of using the cutting edges with the points are also patented. The point has a slight bend and is cut at the correct angle to fit most shares. The cutting edges are shaped and bent to correspond with the share and the point. The cutting edges are manufactured in high carbon steel 3/16 in. thick and are made in three widths—1 in., 1-1/4 in., and 1-1/2 in. Soft center cutting edges are manufactured of 1/4 in. material in 1-5/16 in. and 1-5/8 in. widths.

Prices and complete description of this new product will be sent by writing to the New Process Plow Welding Co., Perry, Iowa.

"Blitzstone"— A New Tinning Flux

Ever since the discovery that a coating of tin on the surface of steel or cast iron served as a decorative and reasonably permanent protection against rust, it has been common practice to use some substance as a flux and as a top covering for the tinning bath. Materials have been and still are available in many forms. Dry salts, as well as solutions of various concentrations are on the market. Many operators insist on preparing their own flux or top covering—often with questionable results. Whatever the form or method of application, the action has been substantially the same.

With the development of "Blitzstone," there has been placed on the market a new fluxing material. This product is available in liquid form, the solution having a gravity of approximately 50 deg. Baume. In this form it may be used both as a dipping flux as well as a top cover for the surface of the tin bath, and has found wide use, both in plate mills and in the tinning of castings. It results in a brighter, smoother and more uniform tinned surface and in many cases completely eliminates the objectionable and costly re-dipping operation.

This new flux is manufactured by American Solder & Flux Co., 4519 Wayne Ave., Philadelphia, Pa.

Type "UM" Metal-Spray Gun

The Union Metallurgique, Mulhouse, France (Export Offices: 12, rue Le Peletier, Paris) claims that some of the factors which have contributed to the success of the Type "UM" gun are the superior fusion of the metal, the high quality and texture of the coating deposited, the fineness of the particles sprayed, the economy in gas consumption, simplicity and convenience of manipulation, freedom from any tendency to back-fire and the equal facility with which it takes hard and soft metals.

Superior fusion of metal is claimed for the Type UM spray gun.

Of these, the outstanding advantage is said to be the fineness of grain. The feature should be apparent to engineers to whom the periodic overhaul of machinery and the application of measures to combat oxidation and corrosion have been troublesome. The gun is a mechanically sound tool, safe and easy to operate, and yet, despite its delicate workmanship, so designed as to insure steady, intensive service for a considerable number of years

Giant Grip Has Four New A-C. Welders

Designed for heavy service in the average industrial plant, Giant Grip Mfg. Co., Oshkosh, Wis., announces a new portable A. C. welder. It is known as the "Industrial" model with a current range from 10 amp. to maximum output and with open circuit arc in three voltages, 80, 85, and 90; but higher voltage can be supplied if desired. The voltage changes are made by changing the leads in the box mounted on the side of the cabinet. It is claimed transformer coils are constructed to permit maximum cooling with elimination of "hot spots" in the center of the coils. Forced circulation provides ample circulation of air. The knife switch control is placed on the front of the cabinet. This welder, its maker states, has reactance control, static high frequency current and other features of construction as assurance to the user that it will not overheat nor burn out under continuous service. It is made in four models, from 300 to 600 amp., and weights from 425 to 850 lbs. Full particulars available from the company at the above address.

News of the Industry

OHIO STATE UNIVERSITY, Columbus, Ohio, announces that its 7th annual welding conference will be held in the Industrial Engineering Building, February 24-25, 1938. O. D. RICKLY, assistant professor of industrial engineering, will be in charge of the conference and any inquiries regarding this program should be addressed to Mr. Rickly.

TEXAS TECHNOLOGICAL COLLEGE, Lubbock, Texas, announces that its next welding conference will be held on February 3 and 4, 1938. J. C. HARDGRAVE, of the Department of Mechanical Engineering, reports that the Lubbock conference will include working exhibits of electric and oxy-acetylene welding. Program of technical papers is not yet completed. Further information can be had from J. C. Hardgrave. The tentative program indicates that the following subjects and speakers will be on the program:

"Welding—The Major Tool of Industry,"
By L. C. MONROE, *The Welding Engineer*, Chicago, Ill. (Illustrated with slides.)

"Hard-facing in the Agricultural Industry,"
By W. S. HILER, Hiler & Co., El Paso, Tex. (Illustrated with slides)

"Reconditioning Pipe Lines Under Pressure,"
Lincoln Electric Co.; motion picture.

"Welded Oil Well Casings,"
By A. C. MULLIGAN, Mulligan Welding Surface Corp., Houston, Tex. (Illustrated with film)

"Petroleum Modernizes With Arc Welding,"
By R. W. VAN KIRK, General Electric Co.

"Flame Hardening with the Oxy-Acetylene Process,"
By F. C. HUTCHINSON, The Linde Air Products Co.

"Modern Metal Working with the Oxy-Acetylene Flame"; motion picture
By United States Department of Interior, Bureau of Mines.

The following are the companies who will be represented at the Lubbock conference:

Big Three Welding Equipment Co., Ft. Worth, Tex.
Compressed Industrial Gases, Inc., Wichita Falls, Tex.
General Electric Co., Dallas, Tex.
Haynes Stellite Co., Kokomo, Ind.
W. S. Hiler & Co., El Paso, Tex.
Hobart Brothers, Troy, Ohio
The Linde Air Products Co., Tulsa, Okla.
Lubbock Hardware & Supply Co., Lubbock, Tex.
Magnolia Airco Gas Products Co., Houston, Tex.
Marquette Mfg. Co., Minneapolis, Minn.
Smith Welding Equipment Corp., Minneapolis, Minn.
Welders Supply Co., Clovis, N. M.
The Welding Engineer, Chicago, Ill.

H. C. MEYER, president of the Foote Mineral Co., Philadelphia, Pa., at a recent meeting of chemists in Cleveland, Ohio, commented on the use of the mineral titanium. "The natural oxide of titanium displays unique properties when combined with certain other materials in dipped or extruded coatings on steel welding rods. It not only promotes a smooth, steady arc, but yields a protective slag of just the right viscosity for the production of a sound fillet or vertical welded joint." Mr. Meyer further stated that it is not improbable that many of the present well-known metals may within the next 50 years become outmoded in favor of certain of the relatively more abundant, but less known metals of today.

GANO DUNN, president of The J. G. White Engineering Corp., New York, for 24 years, has been awarded the 1937 Thomas A. Edison Medal of the American Institute of Electrical Engineers. This is the highest honor in electrical engineering. The award goes to Mr. Dunn, who is also president of Cooper Union, "for distinguished contributions in extending the science and art of electrical engineering, in the development of great engineering works, and for inspiring leadership in the profession." The presentation ceremony will be held on January 26 in connection with the annual four-day winter convention of the A.I.E.E. in the Engineering Societies building, New York City.

THE COMPRESSED GAS MANUFACTURERS' ASSOCIATION, INC., New York City, held its Silver Jubilee meeting at the Waldorf-Astoria in New York, on January 17-18, 1938. This meeting marked the completion of 25 years of energetic and constructive service to the compressed gas industry. This Association for a quarter of a century has handled the technical problems of the many-sided industries which include the production and distribution of commercial gases. It has taken a leading part in matters of safety such as safety in design of containers and methods of safe handling and transporting commercial gases in liquid form and under pressure. The secretary and treasurer of the Association is FRANKLIN R. FETHERSTON, and Association headquarters is at 11 West 42nd St., New York City.

WESTINGHOUSE RESEARCH AT MELLON INSTITUTE

DR. EDWARD R. WEIDLEIN, director of Mellon Institute, Pittsburgh, Pa., has announced the establishment of an industrial fellowship by the Westinghouse Electric & Mfg. Co. for the study of problems in the field of dielectrics and electrical insulation. DR. ROBERT N. WENZEL, a member of the Mellon Institute research staff since 1927, has been appointed fellow in charge of this project. The dielectrics fellowship has as its general objective the development of improved insulating materials and processes for application to equipment of Westinghouse manufacture, and it brings Mellon Institute into cooperation with the Westinghouse Research Laboratories at East Pittsburgh on insulation research.

THE BIENNIAL CENSUS of Manufactures, covering the calendar year 1937, gets under way on January 25, 1938, when schedules will be mailed to manufacturers throughout the country. The census will cover all manufacturing establishments in the United States making products valued at $5,000 or more during 1937.

The Census Bureau has set a goal of greatly increased timeliness in issuing the reports of this convass. The Division of Manufactures has been completely reorganized and strengthened towards this end. Cooperation of manufacturers in returning schedules promptly is necessary, however, if this goal is to be attained. Prompt publication of the figures will greatly enhance their value and the Bureau is making every effort to set a speed record.

New York Section Conducts Lecture Course

A series of 10 evening lectures have been arranged by New York Section, A. W. S., in conjunction with the Polytechnic Institute of Brooklyn, 99 Livingston St., Brooklyn, N. Y. This series of lectures, which started on January 11 and will continue to March 29, is being offered to members of the American Welding Society without any tuition charge. Non-members of the Society can attend the course by paying a fee of $5.00, but an arrangement has been made whereby this payment may be applied toward membership in the American Welding Society, if anyone so desires. Following is a list of the subjects covered in the lectures:

JANUARY 11—Introduction to Proposed Course

By Harry Stanley Rogers, President, Polytechnic Institute of Brooklyn. Introduced by R. W. Boggs, Chairman, New York Section.

The Welding Processes and Symbols. By Leon C. Bibber, Welding Engineer, Carnegie-Illinois Steel Co.

JANUARY 14—Open House

JANUARY 18—Metallography of Welds

By Prof. O. H. Henry, Polytechnic Institute of Brooklyn

JANUARY 25—Some Design Problems in Ship Building

By J. L. Wilson, American Bureau of Shipping

FEBRUARY 1—Designing Machinery for Welding

By Everett Chapman, President, Lukenweld, Inc.

FEBRUARY 15—Elimination or Reduction of Distortion and Residual Stresses in Welding

By G. E. Claussen, Instructor, Polytechnic Institute of Brooklyn

FEBRUARY 21—Designing Welded Structures

By Gilbert D. Fish, Consulting Engineer

MARCH 1—Alloy Steel Welding

By Howard Miller and T. R. Lichtenwalter, Republic Steel Corp.

MARCH 15—Designing Welded Piping Systems Low and High Pressure

By A. N. Kugler, Engineer, Air Reduction Sales Co.

MARCH 22—Designing Pressure Vessels and Tanks

By J. T. Phillips, Foster Wheeler Co.

MARCH 29—Metal Spraying

By J. Magrath, Air Reduction Sales Co.

Sheet Metal Welding—

By W. B. Nicholson, The Linde Air Products Co.

An Exposition of Stainless Steel

An exposition of stainless steel has just opened for a period of several months in the New York Museum of Science and Industry, RCA Building, Rockefeller Center, New York City. This exhibit, which is sponsored jointly by Electro-Metallurgical Co., Unit of Union Carbide and Carbon Corp., New York, and the Museum, will be open every day from 10:00 a. m. to 10:00 p. m.

Every aspect of stainless steel—its history, development, production, fabrication, and uses—is portrayed in a comprehensive, interesting, and educational manner. The display includes hundreds of stainless steel products sent to the exhibit by manufacturers from all over the United States. The

Exhibit of stainless steel products for the food industries.

fields of application receiving especial emphasis are the household, the food and beverage industries, general industry, transportation, architecture, and the medical and dental professions.

The displays of stainless steel products are supplemented by motion pictures and demonstrations showing why stainless steel is an important contribution to mankind, its usefulness in the food industry, its adaptability for strong, light-weight structures and for high-temperature service, and its importance in architectural applications.

Operators give actual demonstrations of oxy-acetylene welding stainless steel in connection with a talk outlining the methods by which many types of stainless steel equipment are fabricated. The "Shotweld" system of joining stainless steel is also demonstrated. It is used in making lightweight structures for aircraft, railroads and other transportation units.

Another feature of the exposition is the part dealing with the production and fabrication of stainless steel. Electric furnaces, ladles of molten stainless steel, ingots, soaking pits, rolling mills, and bars, strips and sheets—all steps in the production of stainless steel and its preparation for fabrication—are graphically illustrated. Fabrication methods are shown, including: forming, drawing, spinning, machining, and the various welding methods.

A. W. S. Activities

Chicago Section, A. W. S. at its last meeting, December 17, 1937, held a discussion on "Flame Hardening." A paper prepared by Dr. G. V. Slottman of the Applied Engineering Department, Air Reduction Sales Co., New York, was presented by an Airco sales engineer, because of Dr. Slottman's inability to be present at the meeting. Two reels of motion picture film (silent and sound) were presented by the Pullman-Standard Car Mfg. Co., detailing the welded construction of passenger and freight cars, as built in their plants. A. M. Unger, welding engineer of Pullman-Standard conducted the discussion.

Toledo Section, A. W. S., just recently organized, held its first meeting Monday, December 13, 1937, at the University of Toledo. A. E. Gibson, president of Wellman Engineering Co., Cleveland, and past president of the American Welding Society addressed the group on the subject of "Welded Fabrication and Design." It is reported that the attendance at this first meeting was 189, which was very gratifying to the officers of the new Section.

San Francisco Section—The December meeting of the San Francisco Section, A.W.S. was exclusively a social affair. Entertainment included dining, dancing, singing, vaudeville and other enjoyable features of a typical festive Christmas party. The affair was held at the Athens Athletic Club, 12th and Clay Sts., in Oakland, on Friday, December 17th. Activities and program were under the direction of Chairman N. F. Ward, and T. R. Rooney, chairman of the program committee.

Los Angeles Section—The regular December meeting of the Los Angeles Section was appropriately termed "Water and Power Night." This meeting featured problems encountered by the Department of Water and Power, of the City of Los Angeles. The meeting was held in the Los Angeles Chamber of Commerce building, 12th St. and Broadway, on December 16th. "Special and Unusual Welding Problems" was the subject discussed by Joseph E. Hood, superintendent of electrical maintenance and repairs in the general plant division of the Department of Water and Power. Martin Fleming, machine shop foreman of the Department's general plant division gave an interesting talk on "Shop Practice in Development and Repair of Equipment." These two features were presented through the cooperation of Clayton M. Allen, junior electrical engineer. Chairman Wayne Howard presided.

Milwaukee Section, A. W. S. at its last meeting held on January 12th at the City Club, 756 No. Milwaukee St., was addressed by W. E. Swift, welding engineer of the American Brass Co. Mr. Swift discussed "Welding Copper and Copper Alloys." He covered the welding of these metals by the oxy-acetylene, metallic and carbon arc processes.

Kansas City Section, A. W. S. at its January 17 meeting discussed "Welding of Industrial Power Plant Piping." F. C. Fantz, vice-president of Midwest Piping and Supply Co., Inc., St. Louis, Mo., presented a paper on this subject and illustrated it with slides. The meeting was held at the Municipal Auditorium.

New York Section, A. W. S., held a joint meeting on January 13 with the Machine-Shop Practice Division of the A. S. M. E. "Jigs and Fixtures For Welding" was the subject of a talk by H. E. Davies of Pollak Manufacturing Co., Arlington, N. J. "Construction and Transportation of a Huge Welded Petroleum-Refinery Tank" was the subject of an illustrated talk by A. Kidd and Richard Aldrich, both of M. W. Kellogg Co., Jersey City, N. J. Eric Oberg, editor of "Machinery," presided at this joint meeting.

San Joaquin Valley Section—"Metallizing" was the theme of the December meeting of the San Joaquin Valley (Calif.) Section held on December 23, at the American Legion Hall, 600 "D" St., Taft Heights, Taft, Calif. Robert E. Kunkler, chief engineer of the Metallizing Company of America, presented a paper on "Metallizing and Its Aid to Industry." Following this, the meeting adjourned to the machine shop of the Manual Arts Department of the Taft Union High School, where several practical demonstrations of the metallizing process were made.

Foreign News

British to Start Calcium Carbide Production

An important announcement is expected shortly to be made by the British Government on the recommendations of the committee which has for some months past been considering the question of manufacturing calcium carbide in the United Kingdom. The committee, whose report is now before the Cabinet, recommends that a carbide industry be established in Britain without delay. All supplies at present come from abroad, a factor which is said to be hampering the development of the acetylene welding industry.

Structural Arc Welding Approved for London

The London County Council on December 7, 1937, formally approved the use of arc welding by adopting a structural welding code which became effective January 1, 1938. The new code is the result of consultation and cooperation between The London County Council and several engineering bodies, including the Royal Institute of British Architects, the Institution of Civil Engineers, and the Institute of Welding. It is stated that the new code is intended to form a basis for handling applications to use structural welding and at the same time to guide the Council in granting permission.

According to "The Welding Industry" (a London publication) it is hoped that "with a more definite basis for the guidance of applicants an impetus will be given to this modern form of construction." One feature which seems rather puzzling is the reported stipulation that "the Council will determine in each case the maximum permissible stresses and the detail arrangement of connections, but the following may be taken as a general indication of the probable maximum stresses which will be permitted by the Council:"

Classification of Stress in Welded Connections	Max. Permissible Stress
Tension and compression in butt welds	16,000 psi.
Shearing in butt welds in webs of plate girders and joists	12,000 psi.
Shearing in butt welds other than webs of plate girders and joists	10,000 psi.
Stress in end fillet welds	12,000 psi.
Stress in side fillet welds, diagonal fillet welds and tee fillet welds	10,000 psi.

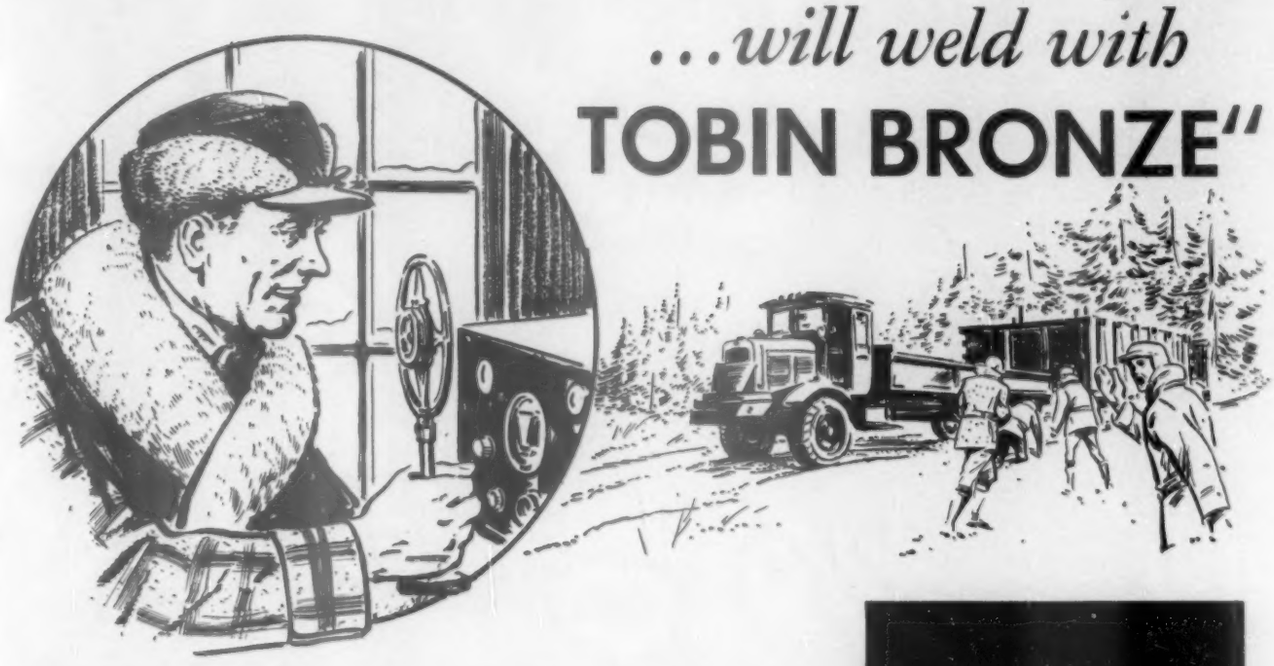
All-Steel Welded Train for Australia

The Cor-ten welded steel passenger train, which is being constructed at the Newport workshops for the "Sydney Limited" service of the Victorian State Railroad, is now approaching completion. In the construction of the 12 units comprising this ultra-modern train, 5 first-class and 4 second-class cars, a dining car, a parlor observation car, and a freight car, welding was adopted on a greater scale than ever before in railroad construction in Australia.

The roof frames have been entirely fabricated by welding. All the side sheets are butt-welded together to form a continuous sheet, which is secured to the side members by riveting and partly by resistance welding. The "bogies" are entirely welded. This has resulted in a substantial saving in weight and cost as compared with riveting. The ends of each car are specially strengthened, and an aluminum apron covering the gaps between the cars gives a semi-streamlined effect for the entire length of the train. The weight of each car will be approximately 42.5 tons.

The adoption of welding and other up-to-date constructional methods, have enabled modern standards of comfort and convenience with a greater degree of safety to be provided in cars weighing approximately the same as the standard wood and steel cars without insulation or air conditioning. The new train will be the first completely air-conditioned train in the Southern Hemisphere.

"Can't wait ten days for parts ...will weld with TOBIN BRONZE"



THE PAS LUMBER COMPANY transports its logs in Northern Canada in a way which is as unusual as it is efficient. Roads are cleared through the woods and levelled; after which huge tanks containing over 30 tons of water sprinkle the road, forming a thick coating of ice. A "rutter" cuts two parallel grooves or ruts in which the sleighs travel, sliding along easily with their log loads of 30 tons each. Huge tractors often bring in 1,000 tons on a single trip.

Cast-iron transfer case breaks at height of season

Last winter, at the height of the logging season, a transfer chain brake on a big truck doubled up and pushed the side out of the cast-iron transfer case.

Short-wave communication with the head office of the Company disclosed the fact that new parts could not be obtained in less than ten days.

Ernest J. Morris, welder and Diesel engineer for the outfit, decided on a repair weld with Tobin Bronze. Preheating the case locally, as is possible with this Anaconda Rod, a strong and oil-tight repair weld soon had the truck back on the job—saving more than a week's tie-up of the logging operations.

This is another instance proving the value of Tobin Bronze for difficult jobs on cast and malleable iron. Experienced welders know that this Anaconda Welding Rod enables the welder to do "impossible" jobs. It flows freely, enabling the welder to weld very rapidly. Ductility and strength, say well-known welders, exceed that of any other rod manufactured for a similar purpose.

Tobin Bronze carries the trade-mark "Tobin Bronze Reg. U. S. Pat. Off." in each rod . . . Look for this trade-mark and be sure you are getting the genuine.

The Tobin Bronze weld which saved at least a week's tie-up

87862

ANACONDA

Anaconda Welding Rods

THE AMERICAN BRASS COMPANY, General Offices: WATERBURY, CONNECTICUT

Offices and Agencies in Principal Cities • In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

Trade News

HAROLD N. EWERTZ has joined the sales staff of ARCOS CORPORATION as of January 1, 1938. Mr. Ewertz is a graduate of Massachusetts Institute of Technology. Prior to his connection with Arcos, he was in charge of sales of welding equipment and supplies of the Austin-Hastings Co., Inc., Boston, Mass.

ROTH WELDING ENGINEERING CO., INC., has been reorganized as the ROTH MANUFACTURING CORP., with headquarters at 13440 Klinger Ave., Detroit, Mich. The company is headed by HENRY H. ROTH, of the former company and well known in the welding industry. Other incorporators are GERTRUDE ROTH and CHARLES S. DEWEY, JR.

EDWIN A. WERT, of the Detroit-Edison Co., has been retained by the Power Piping Division of Blaw-Knox Co. as consulting engineer. Mr. Wert is a member of the A.S.M.E., and has been engaged in pipe designing for the past 20 years. His articles regarding piping flexibility have appeared in several A.S.M.E. papers and other publications. He is also the author of several books, including the Detroit-Edison book on "Piping Flexibility." He has acted in an advisory capacity on piping installations all over the world. Mr. Wert recently conceived and designed an improved type of pipe hanger material. He has developed an innovation for flexibility, shortly to be made available through the Power Piping Division of Blaw-Knox Co.

THE MCKAY COMPANY of Pittsburgh, Pa., announces the appointment of the ARCOS CORPORATION, Philadelphia, as distributor for McKay arc welding electrodes in a territory comprising eastern Pennsylvania, southern New Jersey, Delaware, Maryland, and Virginia.

JOHN F. CUNNINGHAM, supervisor of production for the General Electric Co. since September, 1931, has been appointed assistant to the vice president in charge of manufacturing, succeeding MYRON F. SIMMONS, who is retiring. The appointment was effective January 1, 1938.

THE LINCOLN ELECTRIC CO. manufacturers of arc welding equipment, Cleveland, Ohio, announces the opening of a welding sales-engineering office at Atlanta, Ga. The office is located at 412 Title Building and is to be under the management of ROBERT DANIELS. In addition to prompt supply service, the office will offer free consultation service on any problem relative to the use of welding. Mr. Daniels is a competent welding engineer and electrical engineer.

ABBOTT F. RIEHLE has recently been appointed to the position of sales manager of the Smootharc Welder and Welding Electrode Division of Harnischfeger Corp., Milwaukee, Wis. Mr. Riehle comes to Harnischfeger with a wealth of managerial and sales experience as a background.

A graduate of the University of Pennsylvania, with a degree in mechanical engineering, Mr. Riehle for 10 years was in charge of sales and management of the Riehle Brothers Testing Machine Co. of Philadelphia, which was later taken over by American Machine and Metals, Inc., where he continued in charge of sales. With his wide knowledge of sales, management and the metal markets, Mr. Riehle is believed to be well equipped to handle the sales and promotion end of Smootharc welders and welding electrodes.

ABBOTT F. RIEHLE

DURING 1938, ROBERT W. HUNT CO. will celebrate its golden anniversary, having completed 50 years of service to the construction, railroad, and manufacturing industries. In 1888, this company started operations in a small way with but few employees. The primary purpose of this new company was the inspection of rail steel, but it was later expanded to include other railway materials and equip-

The Improved "Round File" Gas Lighter

Locking "Slip-on" Renewal

—an exclusive feature

The patented cartridge holding the spark metal locks exactly in correct position, permitting instant replacement.

Get acquainted with the many other superior, exclusive features of Improved "Round File." ***Circulars and prices on request.***

SAFETY GAS LIGHTER CO. (Est. 1901) **LYNN, MASS.**

ment. At about the same time, a similar service was inaugurated for the construction industry for the inspection and testing of such materials as cement, structural steel and reinforcing steel to which was added, at a later date, supervision of the erection of steel and concrete structures.

NATHAN R. BIRGE, assistant to the president of the General Electric Co. since 1927, has been elected a vice president. Mr. Birge will be located in Schenectady, where he has carried on his duties in the past.

DR. E. H. LESLIE, well experienced in the chemical process industries, has joined the technical staff of the Blaw-Knox Co., Pittsburgh, Pa. In his new capacity, Dr. Leslie will be charged with the supervision of the design and fabrication of operating units for the chemical and oil refining industries.

DR. E. H. LESLIE

Dr. Leslie is known for his work as consulting engineer and for his operation, since 1923, of the Leslie Laboratories at Ann Arbor, Mich. Through his researches, he has been influential in the application of chemical engineering to the problems of the chemical, petroleum refining, and processing industries generally. He received his bachelor's degree at the University of Illinois, in 1913 and the degree of Doctor of Philosophy at Columbia in 1916. For 8 years, he was professor of chemical engineering at the University of Michigan.

STEEL CORPORATION MAKES IMPORTANT EXECUTIVE CHANGES

DAVID F. AUSTIN, who has been manager of sales, Chicago district, of Carnegie-Illinois Steel Corp. since November, 1935, succeeds C. V. McKAIG as vice president in charge of sales effective January 1, 1938. Mr. McKaig was recently elected vice president of United States Steel Corp. of Delaware (new management subsidiary of the Steel Corp.). Other executive changes in the Carnegie-Illinois sales department, effective the same date, include the following appointments:

THOMAS J. HILLARD, general manager of sales, succeeding J. HALSEY McKOWN, assistant vice president and assistant general manager of sales, who becomes assistant vice president of the United States Steel Corp. of Delaware. PHILLIP M. GUBA, manager of sales of the Chicago district sales office, succeeds Mr. Austin. FRANCIS C. HARDIE, manager of sales of the Detroit district sales office, succeeds Mr. Guba. THOMAS J. BRAY, JR., manager of sales of the Pittsburgh district sales office, succeeds Mr. Hilliard. F. ROYAL GAMMON, manager of sales of the Cleveland district sales office, succeeds Mr. Hardie.

A Titan* rod is available for every bronze welding purpose:

Penn Bronze—is a general purpose rod. It is low melting (1620° F.) and tins easily and uniformly on galvanized, cast, malleable or wrought iron as well as steel, brass, bronze and any other non-leaded metal with a melting point above 1850° F. It makes tough high-strength welds of high ductility, immune to strain hardening and with great abrasion and corrosion resistance.

Titan Manganese Bronze—is used where both hard and tough welds are desired. Although this is a general purpose rod, it is especially recommended for cast iron. It is free flowing and gives extremely dense, non-porous welds.

Titan Bronze—is a tin bronze with uses and characteristics similar to the manganese alloy; penetrates seams and crevices readily.

Double deoxidation—an exclusive feature found only in Titan Welding Alloys—provides protection against the formation of gases and oxides in bronze welding. Thus you are assured of welds that possess definitely greater strength and ductility.

If you haven't tried these Titan Welding Alloys, you are invited to send for samples. Test them, and prove the difference to your own satisfaction. Descriptive literature on request.

*U. S. Patent No. 2,022,439

Titan Metal Manufacturing Co.

Bellefonte, Pennsylvania

ALBERT REICHMANN, has recently retired from the American Bridge Co. He reached the United States Steel Corp. retirement age of 70 on January 16, 1938. Mr. Reichmann, who is a widely known civil engineer has been vice president of the bridge company since 1935. He has been connected with this subsidiary of the Steel Corporation since it was organized in 1901.

HARNISCHFEGER CORPORATION, Milwaukee, Wis., has appointed the STANDARD ASBESTOS MFG. & INSULATING Co., 10 N. Olive St., Kansas City, Mo., as distributors for Smootharc welders and welding electrodes. The territory covered includes Missouri, Kansas, Oklahoma and Texas. Standard Asbestos also handles a complete line of gas equipment. A. W. BENN heads the new welding sales organization. For the past twelve years Mr. Benn was district manager for The Quasi-Arc Co.

NATIONAL CYLINDER GAS Co., Chicago, has appointed the WELDERS' SERVICE Co., Toledo, Ohio, as a distributor for National oxygen and acetylene. A. H. HOMRIGHAUS heads up the Welders' Service Co.

J. J. ROBINSON WELDING SUPPLY Co., Detroit, has been appointed distributor for eastern Michigan for the SIGHT FEED GENERATOR Co., of Richmond, Ind., and also for the VICTOR WELDING EQUIPMENT Co., San Francisco, Calif. ROBERT MCLAIN FALCONER, formerly with Lincoln Electric Co., has joined the staff of the J. M. Robinson Welding Supply Co. RICHARD HANNUM, of Columbus, Ohio, is another recent addition to the sales staff.

WILLIAM H. RICE of Cleveland, Ohio, has been appointed welding instructor at Oklahoma Agricultural and Mechanical College, Stillwater, Okla. ELTON SMITH of Houston, Texas, has been added to the faculty as teacher of machine shop work.

ARCOS CORPORATION, Philadelphia, Pa., has appointed WILLIAMS & Co., INC., with offices and warehouses in Pittsburgh, Cleveland and Cincinnati, as its distributors for stainless and other special electrodes.

INTERNATIONAL TRADES INSTITUTE, INC., 741 W. 70th St. Chicago, has just issued a folder describing its facilities for providing practical instruction in electric and gas welding. Copies of this illustrated folder can be obtained by writing to the school.

NATIONAL CYLINDER GAS Co. of Chicago announces the opening of a district office and salesroom at 2420 University Ave., St. Paul, Minn. This office will supply the Twin City district, as well as the general Northwest territory. Complete service is maintained on welding gases, apparatus, and supplies. V. L. SAGE, well known in the industry, is the district sales manager in charge of the St. Paul branch. Other members of the sales staff are: ELMER BODIN, LESTER ERICSON, MEL KRAFVE, HAROLD PEASE, and MERLE STEEL.

Trade Literature

HOBART BROTHERS, Troy, Ohio, have issued a bulletin describing the new gas engine driven 200-amp. welder. This unit is particularly designed for contractors. Another recent bulletin issued by the same company describes the new heavy duty gas engine driven welder. Copies of either of these bulletins can be obtained by addressing a request to the above company.

AUTOMATIC SWITCH Co., 154 Grand St., New York City, has issued a miniature booklet "Control Valves Electrically." This small booklet covers the general problem of remote control of valves. A copy will be sent free to any one interested in solenoid valves.

THE COMMERCIAL SHEARING & STAMPING Co., Youngstown, Ohio, has issued an illustrated catalog covering its tank heads, tank accessories, boiler heads and stampings. These products are widely used in boiler and tank manufacture and are designed especially for welded fabrication. The new catalog is well illustrated and contains considerable technical information on flanged and dished heads for boilers and unfired pressure vessels. Supporting lugs for tanks are also described and dimensional data is included.

"METAL SPRAYED SURFACES IN RELATION TO LUBRICATION" is the title of a booklet which has just been reprinted for distribution to welding engineers and plant executives by Metallizing Engineering Co., Inc., 44 Whitehall St., New York City. The

Ryerson a dependable source for Welding Rod

● Ryerson Engineers have developed a series of rods that are outstanding for Quality production. More than twenty types, including both electric and gas rods, are carried in stock. Whether you need a shielded arc type for production work or a stainless steel rod you can be sure of immediate shipment... *Write for Bulletin which gives complete data.*

ELECTRODES

Ryerson
Shielded Arc Type No. 215
Shielded Arc Type No. 216
Shielded Arc Type No. 217
Green Processed No. 18

Ryerson
Green Processed No. 6
Bare Mild Steel
Brown Processed
White Flux Coated
High Carbon White Flux Coated
Blue Flux Coated

Ryerson
3½% Nickel Steel Flux Coated
High Manganese Steel Hard Surfacing
Allegheny Stainless Flux Coated
Allegheny Stainless No. 44

GAS RODS

Copper Coated No. 206
Copper Coated No. 210
Cast Iron

3½% Nickel Steel
High Carbon Bare No. 2110

Tobin Bronze
Allegheny Stainless Bare Hard Filler

JOSEPH T. RYERSON & SON, Inc., Chicago, Milwaukee, St. Louis, Detroit, Cleveland, Cincinnati, Buffalo, Boston, Philadelphia, Jersey City

booklet reprints the technical paper presented by HARRY SHAW, consulting and research engineer, at the College of Technology, Manchester, England, on October 20, 1937. Copies of this booklet will be sent free to any responsible individual by addressing a request to the company.

"MUREX HEAVY COATED ELECTRODES" is the title of a recently published pocket size pamphlet issued by The Metal & Thermit Corp., 120 Broadway, New York City. The entire Murex line of electrodes is described in this small booklet, including some 20 different types for mild steel fabrication, repair of manganese steel parts, building up of wearing surfaces and for welding a number of the new high-strength low-alloy steels. Murex electrodes are of two general types: (1) with all mineral coatings anchored to the core wires by spiral windings of asbestos yarn and (2) with coatings which may contain other than mineral ingredients extruded on the core wires under high pressure. Copies of this technical pamphlet may be obtained by writing to the Metal & Thermit Corp., 120 Broadway, New York City.

NEW LINCOLN BULLETIN AIDS WELDING DESIGNER

"How to Change Over to Welded Design for Profits" is the title of a new 32-page, 8 1/2 in. x 11 in. profusely illustrated bulletin just published by The Lincoln Electric Co. Intended as an aid in applying electric welding to the design of machines and machinery structures, the new bulletin sets forth the experiences of many manufacturers who have redesigned their products for arc welded construction.

Of particular interest are illustrations of products as they were formerly built by some other method and their modern arc-welded counterparts. Their construction is clearly shown, together with a comparison of results obtained with the old method and the modern one. Many arc-welded machine parts such as levers, wheels, brackets, frames, bases, containers and covers, which are common to practically every piece of machinery, are illustrated by photographs and line drawings. A study of these small parts and application of the method of welding them enables the designer to visualize larger and more complicated structures arc welded.

The idea that every machine is an assembly of easily designed parts is the message carried to the designer. Changing the product from traditional methods of construction to arc welding is accomplished most simply by converting the component parts one at a time. This step-at-a-time procedure, according to the bulletin, will assure most satisfactory results and greatest economy from application of welding to protect design.

Included in the bulletin are photographs of production executives of many leading industrial concerns which are manufacturing products of arc-welded steel. Statements by these men are enthusiastic regarding the quality and economy of arc-welded construction.

Any executive, engineer, designer or production official interested in obtaining data on this new process of manufacture, which is rapidly gaining acceptance, may obtain a free copy of this bulletin by writing to The Lincoln Electric Co., 12818 Coit Road, Cleveland, Ohio.

YOU WILL GET REAL SERVICE from welding cable that has extreme flexibility, resistance to severe abuse, and insulation that can be relied on for the life of the cable.

Okocord Welding Cable has all three characteristics and, in addition, resists moisture and the destructive action of chemicals. It will give you long, trouble-free service, and do it economically.

THE OKONITE COMPANY

EXECUTIVE OFFICE OKONITE PASSAIC, NEW JERSEY

Classified Section

ADVERTISING RATES

Help Wanted—75c per line, minimum 4 lines. Jobs Wanted—4 lines free. Other Ads—$1.00 per line, minimum 4 lines. Count 8 words to line. Add 6 words for keyed address.

HELP WANTED

WANTED—Large well-rated company desires man to take charge of plant to manufacture shielded arc type of electrodes. Applicant must be familiar with this type of manufacture and must be in position to take complete charge of manufacturing and inspection. Should be familiar with research and development of necessary manufacturing equipment. Replies held in strict confidence. Address Jan-10, The Welding Engineer.

WANTED—Manufacturer's representatives for a line of hard-facing rods. Excellent proposition for the right men. Address The Resisto-Loy Co., Grand Rapids, Mich.

FOR SALE

FOR SALE—Welding shop, well established business doing job welding and radiator repair. Two gas-driven portables, one electric shop welder, full line of torches, grinders, drills, located city 40,000. Terms, cash. Address Jan-1, The Welding Engineer.

BARGAINS—Demonstrator arc welders. Gasoline and electric drive. 30 days' trial. Easy terms if desired. Write Hobart Welder Exchange, Box U-181, Troy, Ohio.

FOR SALE—Tolman insulated electrode holders $5.00. Cutting and welding outfits; supplies. Dependable repair service on torches and regulators. Tolman Mfg. Co. Est. '98; 19 West Third St., S. Boston, Mass.

FOR SALE—Rebuilt 3 in 1 Metallizer gun, practically new, with extra gears ,nozzles and manual, $150; 200-amp. Lincoln 25-cycle welder, $150; 100-amp. gas engine or elec motor welders cheap; many other sizes and types reasonable; 4500-ft. super-flex cable. Address Jan-9, The Welding Engineer.

FLY BALL GOVERNORS—Adapted to all makes of auto engines; belt-driven flat or V. Price, $6.50, prepaid. Ball bearing, $2.00 additional. Satisfaction guaranteed. In ordering state style of belt. Wm. Alber, Beatrice, Nebr.

POSITION WANTED

WELDER—Age 28. Married; 3 yrs. exp. mostly arc welding on steel and stainless. Can read blue prints. Light structural work. Willing to go anywhere. Gas welding and cutting. Address Jan-8, The Welding Engineer.

COMBINATION WELDER—21 yrs. of age. Trained in gas welding at So. Dak. State College. Trained in arc welding at Commercial Gas Co. of Mpls. Practical experience 1½ yrs. in job work. Harry R. Svec, Alpena, S. D.

YOUNG MAN—22 yrs. of age. Recently finished course in arc welding at Fleet Welding School. Some exp. in gas. Will take any job. S. Babcock, Chula Vista, Calif.

YOUNG MAN—Wants job in Canada in welding shop, garage or repair shop. Trained in electric and gas welding. Also trained Diesel engineer. Henry Friesen, Box 95, Manitou, Man., Canada.

DIESEL-ELECTRIC ENGINEER—American. Married. Best of references. Free to travel. Salary secondary if chance for advancement. O. J. Graff, Box 489, Alice, Texas.

ELECTRIC AND GAS WELDER—Graduate Dunn Welding School, Portland, Ore. Experienced; can furnish excellent references. Age 25. Married. Willing to go anywhere. L. Erkenbrack, 3201 First Ave., Hibbing, Minn.

JOB SHOP WELDER—Fully experienced, desires to make connection as working partner in small job shop. Address Jan-11, The Welding Engineer.

ACETYLENE WELDER AND GENERAL REPAIR MAN—14 yrs. exper. on all metals. Single. Will travel or locate anywhere. Harry D. Kuhn, Mooseheart, Ill.

ARC WELDER—With limited experience. Will take job as helper to gain more experience. 25 yrs. Single. Hollup graduate. Address Jan-12, The Welding Engineer.

COMBINATION WELDER—Age 24; 6 years' experience on refinery and oil field maintenance; pipe; all position welding; light and heavy plate and structurals; layout and cutting. Single, willing to go anywhere. Interested in foreign field work. Address Jan-13, The Welding Engineer.

ARC WELDER—Tech. training, good mechanic, wants work with job shop as helper. Prefer Middle-West. John E. Vaupel, Route No. 1, Pekin, Ill.

ARC WELDER—Graduate. Passed tests on vertical and overhead welding. Will accept job anywhere. 29 yrs. old. George Pence, 4510 W. 61st St., Chicago, Ill.

WELDING SUPERVISOR OR INSPECTOR—27 yrs. practical exp. on gas and electric welding. All around work on boilers, piping, tanks, structural work. Will go anywhere. Address Jan-2, The Welding Engineer.

COMBINATION WELDER—19 yrs. exp. 4 yrs. Lincoln Fleetweld. Age 43. General maintenance or pipe work preferred. Address Jan-3, The Welding Engineer.

WELDER—28 yrs. exp. in job welding shop. Married. Experienced on ferrous and non-ferrous, alloy steels, tanks, piping. Prefer job shop. Can supervise work in busy job shop. Willing to go anywhere. Address Jan-4, The Welding Engineer.

ARC WELDER—18 mo. exp. (all positions) on light and heavy stainless, steel plate, structural, and machinery repair. Age 23. High school, Jourden Diesel, and welding school graduate. Must support dependent members of family. Will consider New England, So. America, any European country. Address Jan-5, The Welding Engineer.

COMBINATION WELDER—Experienced all classes of code welding. 12 yrs. railroad, refinery, and concrete work. Last 4 yrs. with Texas Co. High school graduate. Own portable. Address Jan-6, The Welding Engineer.

COMBINATION WELDER—Job shop or industrial plant. 25 yrs. exp. Metal expert. Can handle men. 4 yrs. exp. as welding engineer and salesman for large oxygen co. Address Jan-7, The Welding Engineer.

ARC WELDING HANDBOOK

By C. J. HOLSLAG

Chief Engineer, Electric Arc Cutting & Welding Co.

A simple and practical manual of instruction for arc-welding operators. Step-by-step methods of instruction are used so the beginner may understand both the equipment and the welding process itself. Also contains several chapters on methods of application of arc welding. Chapter questions make it possible for the student to test his assimilation of the subject matter covered.

30 Chapters, 267 Pages, 5x7¼ inches, 50 Illustrations. Flexible Binding. Shipped Post paid

$2.00

THE WELDING ENGINEER PUBL. CO.

608 South Dearborn Street CHICAGO, ILLINOIS

AMERICAN INSTITUTE OF STEEL CONSTRUCTION has issued the third revised edition of the Manual on Steel Construction. This manual has been a guide book for engineers and constructors for the past 10 years. The third edition contains much new data indispensable to engineers, architects and others interested in the design, fabrication and erection of structural steel for buildings and bridges. A feature of the new edition is the complete revision of all the tables based upon the standard unit stress of 20,000 psi. Many of the building codes of the larger cities have already been revised to this unit stress and it is expected that most of the others will promptly do the same. The third edition includes the revised standard fusion welding symbols of the American Welding Society.

DAVIS EMERGENCY EQUIPMENT CO., INC., 55 Van Dam St., New York City, has issued a new catalog covering its line of industrial protection equipment. In addition to protective clothing and gauntlets of various types, the catalog describes several welding helmets and the company's Drednaut welding goggles.

"WELDING COMPOUNDS AND FLUXES" is the title of a pocket-sized catalog just issued by Anti-Borax Compound Co., Fort Wayne, Ind. The products listed are used in oxy-acetylene welding and brazing.

Obituary

JAMES S. PHIFER, for the past 27 years superintendent of the Allentown, Pa., plant of the American Steel & Wire Co., died December 22, 1937 of a heart ailment which had incapacitated him for several months.

JOHN A. CAPP, engineer of materials in the General Electric Works Laboratory at Schenectady, N. Y., died January 6 after a short illness. He would have been 68 years of age on January 14 and was a veteran of more than 45 years' service with the company.

Have you a BRAZING problem

Regardless of whether the problem involves ferrous or non-ferrous metals of either light or heavy section, or whether the work is production or maintenance, Low Temperature Brazing may prove to be the solution.

As manufacturers of silver solders and silver brazing alloys, we have been closely connected with brazing problems in many industries and have cooperated in the solution of a great number and wide variety of problems.

With this wide experience, we may be able, not only to help you improve the quality of your brazing, but also to reduce your brazing costs.

If you have a brazing problem, write us. Send us full details about the metals to be joined — we'll be glad to offer our recommendations.

Among our products widely used for both production and repairs in many industries, are the *low temperature* brazing alloys SIL-FOS and EASY-FLO and the low temperature HANDY FLUX. Try them on your work — Write us for full details.

HANDY AND HARMAN · 82 Fulton St., New York
BRIDGEPORT, CONN. PROVIDENCE, R. I. TORONTO, CANADA